The area is almost 0.25 Km^2 and rather undulating. The elevation varies from 50 m to 75 m. There are two small impetuous streams at the center of the premises, flowing from North to South. They are about 2.0 to 3.0 m wide and which ultimately flows the Marikina River. The two streams and the Marikina River appear to have no economically vital utilization because of the contaminated water (Refer to Table 10.2.1 Water Analysis of the Marikina River). The causes are due to; wastewater discharge from residential areas and factories and illegal disposal of garbage. Some places along the river sides are occupied by squatters. Due to these factors it is evident that no irrigation users were discovered.

The land not occupied by the facilities such as the sedimentation basins, filters, chemical house and chlorine house are mostly covered with gardens and cultivated land.

Vegetation in the area is mostly mixed garden, cultivation of banana and papaya and common trees in the Philippines such as acacia, ipil-ipil, tamarind and mango. There are no specific wildlife habitants. Animals found in the area are mostly livestock.

10.3 Effects of the Project on Environmental Resources

The proposed project described in Chapter 9, consists mainly of replacement of existing equipment and very minor civil works. The purpose of the rehabilitation plan is to upgrade the water quality and the Operation and Maintenance (O & M) of the water treatment plant. The plan does not include, however, any alterations in the distribution system, transmission pipeline, pumping stations and reservoirs.

The following description is to show the potential effects of this project on the environmental resources of the study area.

A summary impact matrix is shown in Table. 10.3.1

Since the proposed plan is to provide a prevalent water treatment system for the citizens, this will not affect adjacent land use,

cultural resources or aesthetics.

The plan will be confined to equipment replacement and some minor civil works. The civil works shall consists of provision of launders and perforated baffles for existing sedimentation basins; small scale excavation to build washwater recovery basin (L-20.0 m X W-16.0 m X H-4.0 m), and repair of roofs/doors/windows. These works are of the type that the contractor will be able to implement control measures to protect the river and its environment from new water pollution. Also, there will be very minor temporary inconveniences like noise and air pollution inside the premises during the rehabilitation work. Removal of excess soil will be conducted within the premises and the means of grading and seeding are controllable activities.

During the operation of the facility, inorganic and harmless sludge removed from raw water is discharged to the streams within the Plant. This has been the practice ever since the plant commenced its operation in 1935. In the near future it would be appropriate to treat the sludge after the completion of sewage treatment plants for Metro Manila. In addition, the sludge is harmless and the volume discharged is approximately 35.2 t/d of dry solid which is relatively small as compared to the flow rate of 38.9 X 10^6 to 58.8 X 10^6 m^3/day of the Marikina River. (Reference: "MARIKINA RIVER MULTI PURPOSE PROJECT Feasibility Study 1978 Review and Evaluation Report") Also, the quality of water in the River is very contaminated and no utilization occurs in the downstream.

No chronic air pollution is expected from the operation of the facilities. There is a minor air quality risk which is associated with the storage, handling and use of chlorine gas in the disinfection train. The record of the existing facilities in this regard is satisfactory, with few accidents reported from chlorine leaks. Existing safety practices for handling chlorine should be reviewed and updated as needed, and subsequently implemented in the new facilities. Actually, the rehabilitation plan includes improvement of the storage house and replacement of superannuated chlorinators, evaporators, chlorine leak detectors, exhaust fan, hoist for handling chlorine cylinders, chlorine booster pumps and safety devices. Also

this project will include recommendations for the proper handling of chlorination facilities.

From a human resource point of view, the reliability of the water quality will be vastly improved with the upgraded plant. The plant regarded as one of the important infrastructures in Manila is presently yielding and transforming about 60 percent of the total safe water supply in Metro Manila thus performing a crucial function in meeting one of the basic needs of Metro Manila residents.

Public health, although not presently at risk despite the superannuated facilities will be better served by an upgraded and efficiently operated system.

10.4 Conclusion

The basic environmental resources of the plant premises were reviewed to substantially evaluate potential effects of the rehabilitation project and from the subsequent operation of the plant after the completion of the project. The rehabilitation work consists mainly of replacement of mechanical and electrical equipment and minor civil works; construction of launders and perforated baffles in existing sedimentation basins. Therefore there will be no specific changes in the environmental aspects and no lasting adverse effect was identified as a result of the proposed rehabilitation work.

10.5 Recommendation

There are no potential lasting adverse environmental effects that was identified during this feasibility study. Although there is one small stream crossing the premises to which sludge removed from raw water is being discharged, this has no sufficient environmental and economical value. Also, it was noted that no wildlife habitants and specific vegetation exist in that specific area.

Accordingly, from a human resource and public health aspect, the implementation of the project should be conducted immediately. The remaining life of superannuated facilities which supplies safe water

for Metro Manila cannot wait for a much longer time before it is rehabilitated.

Note: A letter requesting an exemption from EIA requirement, which was submitted to Environmental Management Bureau, DENR, is attached in Supporting Report as Appendix N.

Table 10.2.1 WATER ANALYSIS OF THE MARIKINA RIVER (1990)

DATE	SOURCE OF SAMPLES	TURBIDITY (UNIT)	pH	Cl - (mg/l)	DO (mg/l)	BOD (mg/l)	COD (mg/l)	SS (mg/l)	F. Coli (MPN)
Jan. 3	A. Bonifacio Ave.	23.0	7.9	8.0	5.5	3.4	15.2	20.2	70 X 10 3
	Marcos Bridge	16.0	7.9	20.0	2.6	2.4	15.2	14.6	33 X 10 3
	Guadalupe Bridge	202.5	8.2	76.0	5.4	3.6	15.2	237.1	49 X 10 3
Jan. 31	A. Bonifacio Ave.	25.8	6.8	16.0	4.8	4.4	101.7	27.1	23 X 10 4
	Marcos Bridge	28.3	6.8	22.0	1.1	14.3	84.8	32.1	49 X 10 4
	Guadalupe Bridge	167.0	6.9	43.0	2.8	3.0	101.7	213.5	33 X 10 4
Feb. 28	A. Bonifacio Ave.	28.2	7.1	19.0	4.9	2.0	104.4	21.5	79 X 10 4
	Marcos Bridge	16.2	6.8	29.0	0.0	10.7	87.0	10.8	49 X 10 5
	Guadalupe Bridge	197.8	6.7	44.0	0.4	6.3	95.7	167.4	13 X 10 5
March 28	A. Bonifacio Ave.	22.5	7.1	21.0	1.6	7.9	89.4	32.6	23 X 10 4
	Marcos Bridge	23.8	6.9	29.0	1.2	22.8	105.7	32.6	23 X 10 4
	Guadalupe Bridge	58.3	6.3	175.0	0.0	33.5	268.3	55.0	33 X 10 4
April 25	A. Bonifacio Ave.	-	-	-	-	-	-	-	-
	Marcos Bridge	77.2	6.9	32.0	0.0	34.0	80.5	65.3	11 X 10 5
	Guadalupe Bridge	-	-	-	-	-	-	-	-
May 23	A. Bonifacio Ave.	38.5	7.7	35.0	2.0	41.8	113.0	30.2	49 X 10 4
	Marcos Bridge	45.0	7.5	32.0	0.0	53.3	130.4	38.4	13 X 10 5
	Guadalupe Bridge	127.0	6.7	100.0	0.0	19.0	460.9	131.0	13 X 10 5
June 6	A. Bonifacio Ave.	49.5	6.8	32.0	0.0	15.5	125.0	37.6	23 X 10 4
	Marcos Bridge	49.5	6.8	33.0	2.0	19.2	141.7	48.0	13 X 10 5
	Guadalupe Bridge	49.8	6.6	80.0	0.0	15.0	150.0	50.5	13 X 10 5
July 4	A. Bonifacio Ave.	177.5	7.6	22.0	6.8	3.4	102.4	159.0	49 X 10 3
	Marcos Bridge	188.8	7.6	20.0	6.2	4.8	94.5	171.0	79 X 10 3
	Guadalupe Bridge	205.5	7.2	90.0	3.6	11.2	330.7	197.0	49 X 10 4
Aug. 1	A. Bonifacio Ave.	147.0	7.1	22.0	7.0	1.5	76.9	131.0	49 X 10 4
	Marcos Bridge	172.0	7.0	20.0	7.2	3.0	92.3	150.0	33 X 19 4
Aug. 8	Guadalupe Bridge	69.0	6.9	339.0	5.2	3.0	66.7	65.0	94 X 10 4
Sept. 5	A. Bonifacio Ave.	127.0	7.2	5.8	7.8	2.3	57.6	132.0	49 X 10 5
	Marcos Bridge	-	-	-	-	-	-	-	-
Sept. 12	Guadalupe Bridge	51.5	6.7	415.0	5.3	3.4	37.0	64.0	-
Oct. 10	A. Bonifacio Ave.	-	-	-	-	-	-	-	-
	Marcos Bridge	-	-	-	-	-	-	-	-
	Guadalupe Bridge	24.8	6.8	485.0	3.3	5.6	100.0	29.0	33 X 10 4
Nov. 21	A. Bonifacio Ave.	67.5	7.1	35.0	7.4	1.3	83.3	70.0	79 X 10 4
	Marcos Bridge	-	-	-	-	-	-		
	Guadalupe Bridge	-	-	-	-	-	-		
Dec. 5	A. Bonifacio Ave.	47.5	7.6	5.0	6.8	2.3	66.7	50.0	13 X 10 4
	Marcos Bridge	-	-	-	-	-	-	-	-
	Guadalupe Bridge	45.0	7.1	47.0	4.0	2.4	100.0	53.0	23 X 104

Table 10.2.1 WATER ANALYSIS OF THE MARIKINA RIVER (1990)

DATE	SOURCE OF SAMPLES	TURBIDITY (UNIT)	pH	Cl - (mg/l)	DO (mg/l)	BOD (mg/l)	COD (mg/l)	SS (mg/l)	F. Coli (MPN)
Average	A. Bonifacio Ave.	68.5	7.3	20.1	4.9	7.8	85.1	64.7	86 X 10 4
	Marcos Bridge	68.5	7.1	26.3	2.3	18.2	92.5	62.5	16 X 10 5
	Guadalupe Bridge	108.9	6.9	172.2	2.7	9.6	56.9	114.8	65 X 10 4
Minimum	A. Bonifacio Ave.	22.5	6.8	5.0	0.0	1.5	15.2	20.2	49 X 10 3
	Marcos Bridge	16.0	6.8	20.0	0.0	2.4	15.2	10.8	33 X 10 4
	Guadalupe Bridge	24.8	6.3	43.0	0.0	2.4	15.2	29.0	49 X 10 3
Maximum	A. Bonifacio Ave.	177.5	7.9	35.0	7.8	41.8	125.0	159.0	49 X 10 5
	Marcos Bridge	188.8	7.6	33.0	7.2	53.3	141.0	171.0	49 X 10 5
	Guadalupe Bridge	205.5	8.2	485.0	5.4	33.5	460.9	237.1	49 X 10 5

SOURCE: CENTRAL LABORATORY, MWSS
TAB6-1B.WK1

Table 10.3.1 ENVIRONMENTAL CHECKLIST (WATER SUPPLY)

	CHECK ITEMS	MAJOR	SMALL	NONE	NOT CLEAR	PROBLEMS	ACTION TO COUNTERMEASURES PLANNED	REMARKS
POLLUTION	1.Air pollution resulting from chlorination		X				Monitoring and alarm system included in design	
	2.Soil erosion following the cutting of trees, etc, facility construction and consequent deterioration of water quality downstream		X				Construction site management practice recommended	Scale of excavation is very small. Implementation of control measures should be a condition stipulated in the contract documents.
	3.Noise and vibration around water treatment plant			X				Premises is broad and equipment of the noise free type
	4.Ground subsidence			X				No related works
	5.Treatment of sludge from water treatment plant							Inorganic constituents and harmless
NATURAL ENVIRONMENT	1.Effect of construction on the ecology			X				Main work is Mechanical & Electrical Equipment
	2.Effect on landscape			X				same as existing
HUMAN ENVIRONMENT	1.Effect of construction of the facility on the historical and cultural heritage			X				
	2.Effect on existing infrastructure			X				
	3.Effect on other water uses			X				
OTHERS	1.Effect on the environment during construction period			X				
	2.Environmental monitoring			X				not necessary

TAB6-1.WK1

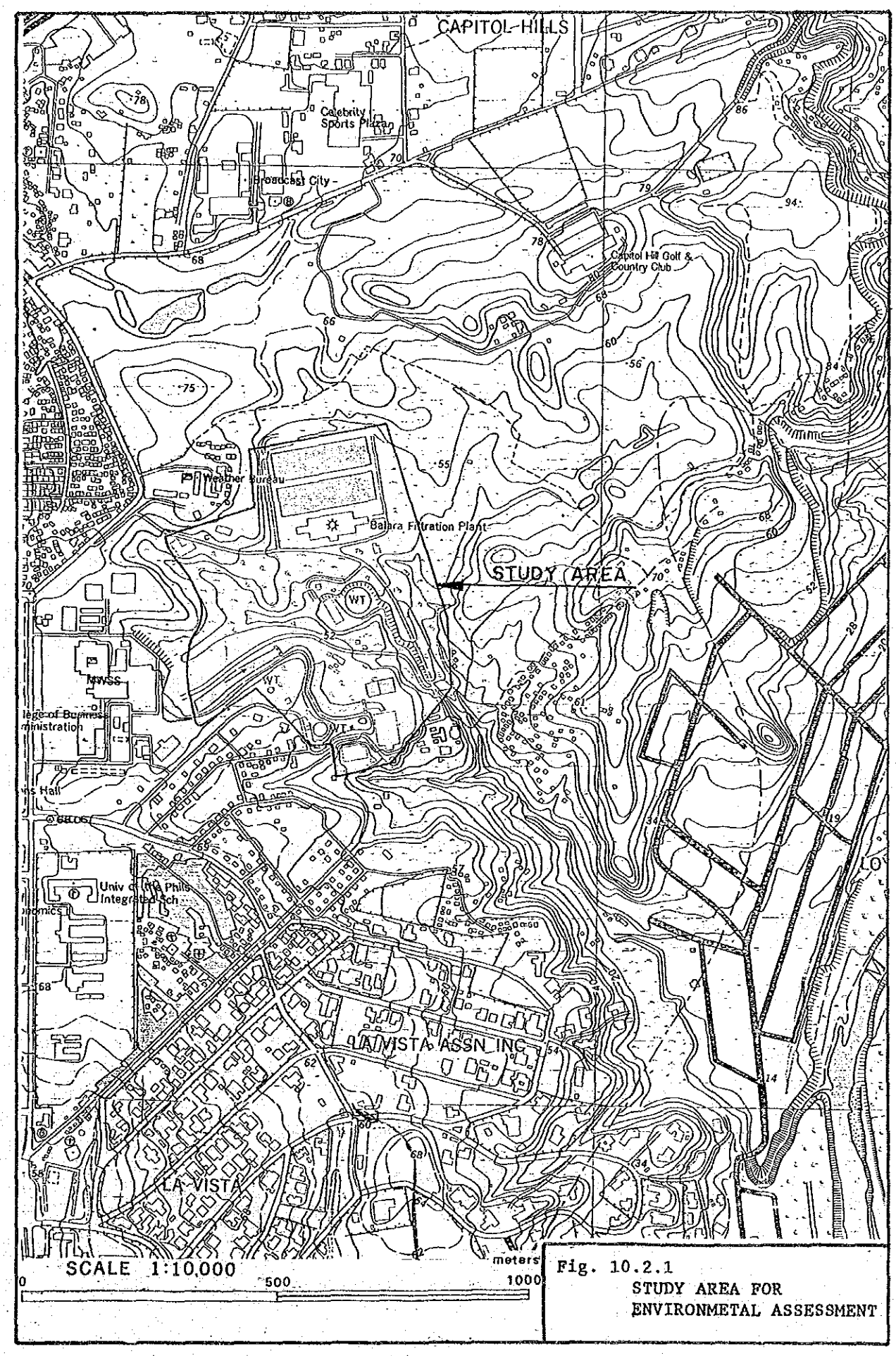


Fig. 10.2.1
STUDY AREA FOR
ENVIRONMETAL ASSESSMENT

CHAPTER 11 PROJECT COST ESTIMATE

11.1 Basis of Cost Estimate

Based on the rehabilitation plans, the project costs are estimated under the following conditions.

1) It is assumed that all construction works shall be contracted to general contractors or plant manufacturer by international tender.

2) All base costs are expressed under the economic conditions that prevailed in September 1991.

3) The Construction Cost consist of equipment, material and installation cost, transportation charge, civil and architectural work and overhead.

4) Engineering charge is assumed at 10% of the construction cost.

5) Physical contingency allowance at 8% of the total of construction cost and engineering charge.

6) It is assumed that flow control system for filter effluent and washwater shall use the same system as the existing and only replacement of damaged equipment shall be included in this project. In case there are any difficulties to procure the equipment, the scope of works and cost estimation of this project shall be reviewed.

11.2 Estimated Project Cost

The total project cost of Level 2, consisting of construction cost, engineering charge and physical contingency, amounts to 686,947 thousand Peso at 1991 price as shown in Table 11.2.1.

The breakdown of recommended level namely, level 2, is estimated in Table 11.2.2

TABLE 11.2.1 PROJECT COST COMPARISON

Cost Item	Amount (1,000 Pesos) Level 1	Level 2	Level 3
A. Construction Cost			
a. Plant No. 1	28,182	96,047	145,669
b. Plant No. 2	59,278	248,269	355,729
c. Chemical/chlorination/Others	34,925	51,560	52,602
d. Electrical equipment	117,982	182,362	208,382
Sub Total	240,367	578,238	762,382
B. Engineering charge (D/D,C/S, 10%)	24,037	57,824	76,238
Total	264,404	636,062	838,620
C. Physical Contingency (8%)	21,152	50,885	67,090
Grand Total	285,556	686,947	905,710

Note: D/D---Detailed Design
C/S---Construction Supervision
1 PESO = 5.14 YEN

TABLE 11.2.2 PROJECT COST OF LEVEL 2

Cost Item		Amount (1,000 Pesos)
A. Construction Cost		
a. Plant No.1		96,047
	Aqueduct No. 1 & No. 2	1,274
	Rapid Mixing	2,793
	Flocculation	28,346
	Sedimentation	12,426
	Accelators	9,796
	Filtration	31,276
	Washwater transmission	4,817
	Washwater recovery	5,319
b. Plant No. 2		248,269
	Flocculation	160,025
	Sedimentation	14,172
	Filtration	51,515
	Washwater transmission	7,852
	Washwater recovery	14,705
c. Chemical/chlorination/Others		51,560
	Chemical dosing Alum	11,745
	Chemical dosing chlorine	26,435
	Chemical dosing Polymer	1,738
	Laboratory Equip.	5,850
	Miscellaneous	5,792
d. Electrical equipment		182,362
	Power receiving	23,377
	Low Voltage main service line	11,631
	Motor Control Panel	52,414
	Lighting Panel	644
	Distribution Panel	1,175
	Starter Switch of Booster pump	1,738
	Flow Meter	15,662
	Level Meter	4,196
	Instrumentation of Filter beds	49,748
	Instrument Panel	5,667
	Interior Lighting	4,369
	Street Lighting	5,588
	Lighting Facilities	3,871
	Generator for Chlorination equip.	1,307
	Testing equipment	975
Sub Total		578,238
B. Engineering charge (D/D,C/S, 10%)		57,824
Total		636,062
C. Physical Contingency (8%)		50,885
Grand Total		686,947

Note: 1) D/D is Detailed Design
2) C/S is Construction Supervision

CHAPTER 12 IMPLEMENTATION SCHEDULE

12.1 Implementation Schedule

The implementation schedule of the rehabilitation project was planned taking into consideration the features of rehabilitation, financial resources and the duration required for each item of rehabilitation work, as well as considerations to ensure minimum interruption of water production during the implementation.

As far as financial resources are concerned, the MWSS strongly desires the Japanese Grant Aid program to be used in the implementation of the project instead of foreign loan assistance. In both cases, negotiations for external financial resources should commence in early 1992. The engineering services for the detailed design including funding arrangements and review will require about fifteen months to complete.

In the formulation of the construction schedule (as shown in Fig.8.1.2) the following items were taken into consideration:

(1) Possibility of reduced water production

It is regarded that it is still impossible to meet the expected demand even if La Mesa No. 2 begins its operation in 1993 since the total demand will almost be equal to the production capacity and considering further that the areas being served by the La Mesa and Balara Plants are almost independent from each other. Therefore, it appears that the possibility of reduced production of the Balara Plant is non-existent.

(2) Possible duration of suspended operation

The possible duration within which the operation of the Plant can be temporarily suspended to accommodate repair works is about 1.5 - 2.0 hours taking into consideration the range of water level available for use at the San Juan reservoir which was reported to be between 47.0 - 48.5 meters.

(3) Fluctuation of raw water quality

Considering the high raw water turbidity (40 - 80 mg/l) during the rainy season, it is evident that suspending the operation of the filter facilities and sedimentation basins during these months is not advisable. The rainy season is from the months of June to September. Therefore, the rehabilitation work should be conducted during the remaining eight months of the year.

(4) Electricity

Utilities like electricity is not considered to affect the implementation schedule.

(5) Possibility of isolating each basin/bed

Basically each basin /bed can be isolated from the overall operation of the Plant during rehabilitation activities, provided that the interruption of the filters will affect only one group of five beds to stop operating when the inlet and drain sluice gate is rehabilitated. Providing that the application for funding arrangements commences in 1992, the entire project is expected to be finished in 1995 considering that the actual rehabilitation work requires about two years to be completed. The implementation schedule is shown in Fig.12.1.1.

12.2 Construction Details

(1) Sedimentation Basin

As explained in the previous paragraphs, the rehabilitation work will be scheduled during the period of low water turbidity (dry season).

1) Plant No. 1

The rehabilitation work will be executed in phases to ensure minimal interruption in water production. Therefore, the temporary process that will prevail during the rehabilitation work will be similar to

direct filtration.

2) Plant No. 2

The rehabilitation of the parshall flumes entails no problem since this item involves only the replacement of level meters.

As to the flocculation and sedimentation facilities, the work which involves the rehabilitation of 12 basins is scheduled to take eight months to complete. In order to meet this schedule , three (3) basins will be rehabilitated simultaneously.

(2) Filtration

The rehabilitation work for this facility will also be scheduled during the low turbidity season. As shown in the construction schedule, the work should be accomplished in eight(8) months. To achieve this , four (4) beds should be rehabilitated simultaneously. In such cases, load at the other filter beds will increase by 15%. In order to cope with the additional loading, the replacement of washwater should be done prior to the rehabilitation of the filter beds to ensure the efficient performance of backwashing.

(3) Motor Control Panel/ Distribution Panel and Chlorination equipment

All the replacement equipment will be installed directly adjacent to the existing defective equipment to facilitate the immediate shift of operation from the old equipment to their new replacements.

(4) Chemical Dosing/ Washwater/ Water Recovery Facilities

During the rehabilitation, the functions of the equipment to be replaced will be performed by temporarily installed pumps and pipelines.

Fig. 12.1.1 IMPLEMENTATION SCHEDULE

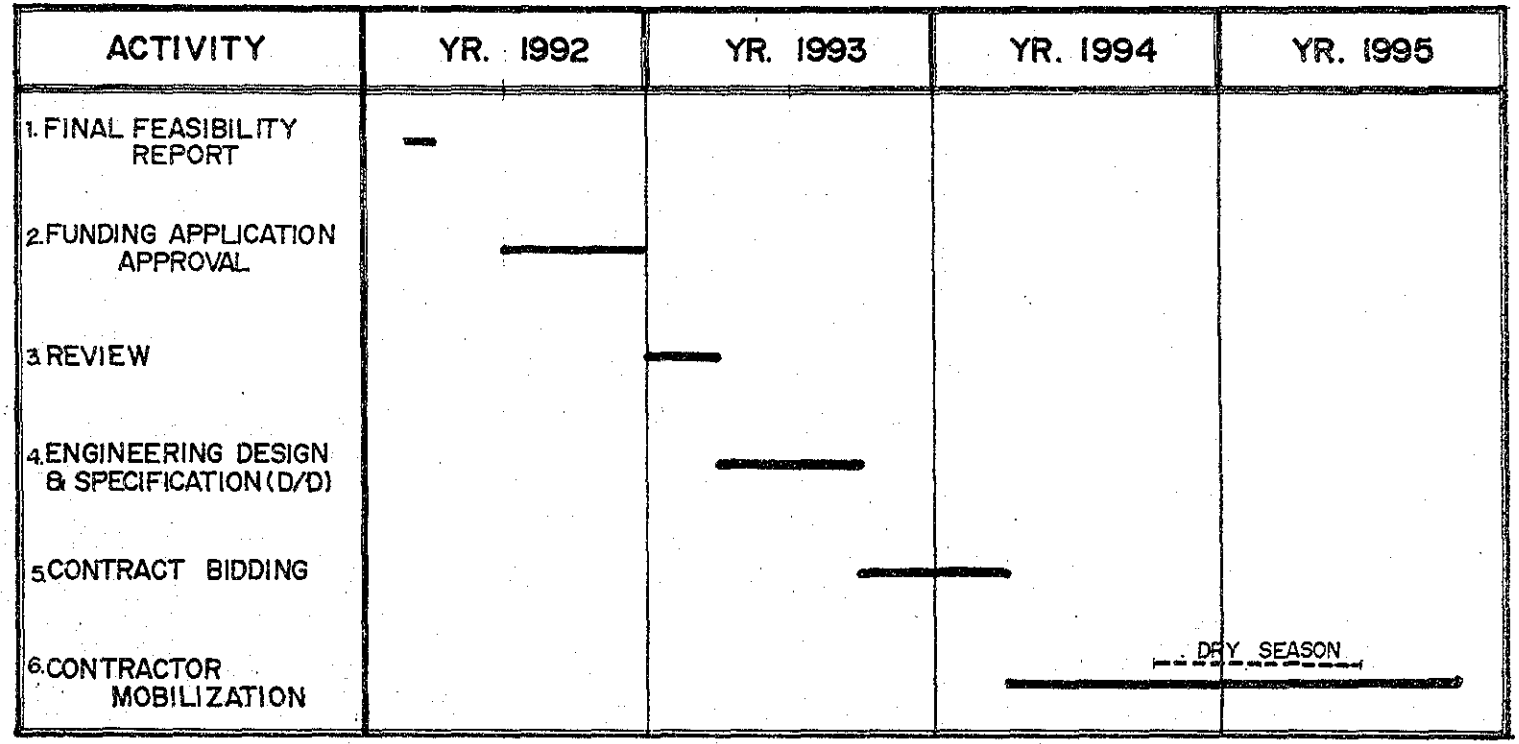
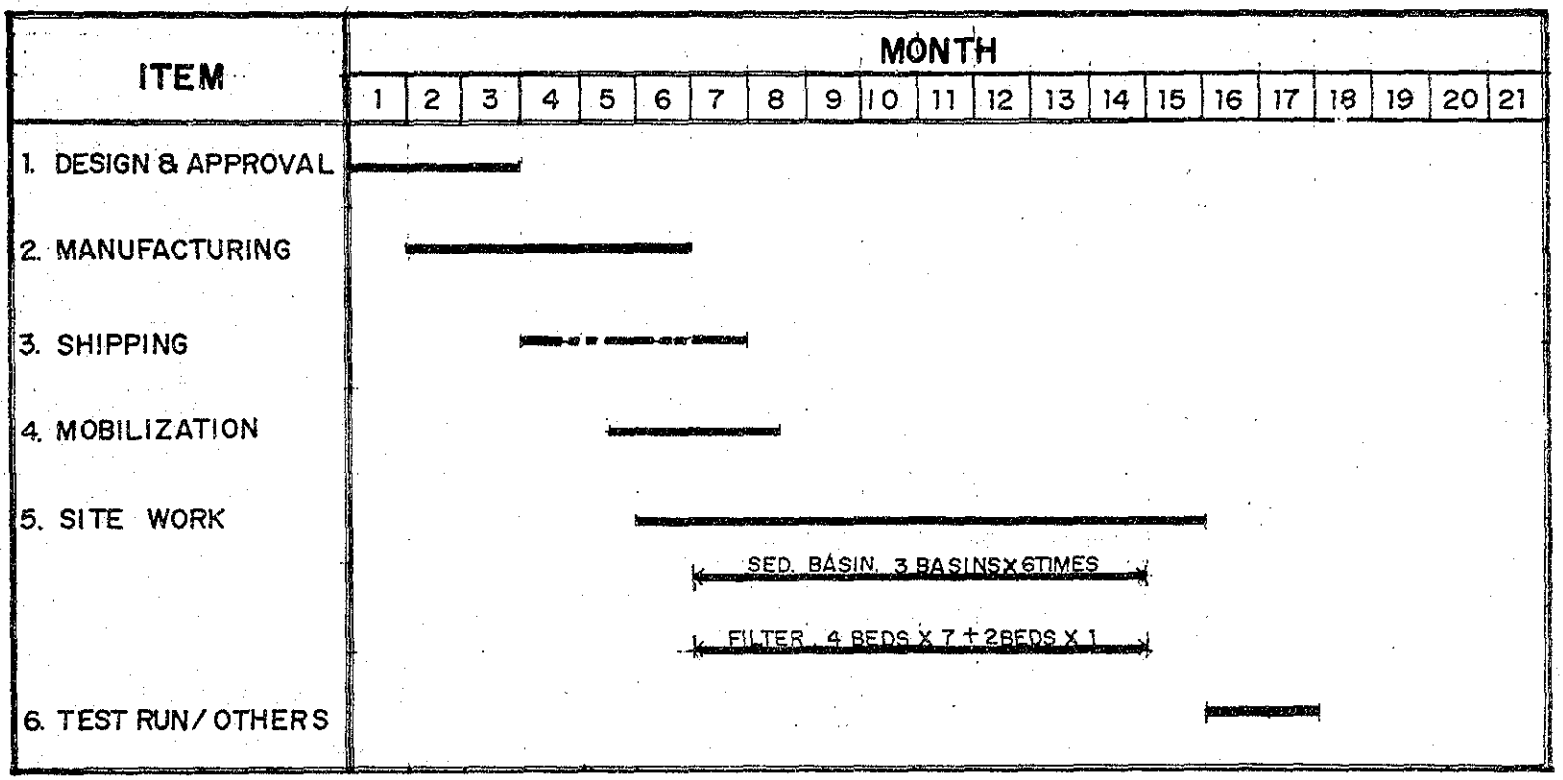


Fig. 12.1.2 CONSTRUCTION SCHEDULE



CHAPTER 13 FINANCIAL ANALYSIS

This chapter is focused on the net cash flow after rehabilitation and without rehabilitation, shows the FIRR, performs sensitivity analysis, present a cash flow analysis of MWSS with summary & conclusions.

Level 2 is considered as the base for adjusting cost factors of level 1 and level 3.

13.1 General

The objective of the financial analysis is to determine net cash benefits of the rehabilitation project by computing the difference in net cash flow after rehabilitation and without rehabilitation. The rehabilitation costs are derived on the basis of the rehabilitation level. Three levels of rehabilitation costs will be considered. The net benefits are the net cash flow derived from the difference between those with rehabilitation and those without rehabilitation.

The criterion used in the evaluation of financial viability is the financial internal rate of return (FIRR), the concept of obtaining the net financial benefits with the available resources. The financial evaluation provides those concerned with the justifiable and practical yardstick to select the financial merits and demerits of a project.

13.2 Financial Benefits

The net financial benefits are the net cash flow derived from the difference in net cash after rehabilitation and without rehabilitation. Without rehabilitation, the negative cash flow includes (1) loss of water revenue, (2) loss of other revenue, (3) operation & maintenance cost without rehabilitation, as indicated in columns (1), (2), and (3) of Table 13.3.2. Column (4) is the sum of columns (1) through (3). With rehabilitation, the project cost in the form of loan as cash inflow in column (5), investment in column (6), loss of revenue in column (7), operation and maintenance cost in column (8),

depreciation in column (9), interest payment in column (10), tax in column (12), and project cash flow, the difference between column (4) and the sum of columns (6) through (12) is indicated in column (13). Column (13) is the net cash flow with rehabilitation. The net difference between cash flow with rehabilitation and without rehabilitation is the contribution to the net cash flow of MWSS, as indicated in column (14).Column (4) and column (13) have negative signs, indicating cash outflows while positive signs are cash inflows.

13.3 Items of Financial Benefits

A brief description of each of the items of financial benefit is presented in Tables 13.3.1 and 13.3.2.

13.3.1 Efficiency of the Equipment

The production of safe and drinkable water depends upon how efficiently the equipment works. Without rehabilitation, some facilities like chlorinators, directing qualitative aspects, are expected to be remarkably damaged in several years, and the other facilities like filter, directing quantitative aspects, are also expected to reduce their functions in connection with those related process such as coagulation, flocculation, and sedimentation which are simultaneously expected to reduce their functions. Thus it is reasonably assumed that water production will decrease at the compounded rate of 1 %, reaching 82 % level of water production in the 20th year.

13.3.2 Loss of Water Revenue

Water safety must be maintained at all times, thus should be given top priority. However, the declining efficiency of the equipment at the Balara Plant will reduce the water production. This is indicated in Table 13.3.1.

The loss of water production will reduce water revenue. The loss of water revenue is estimated on the basis of:

(DWP)(Days)(Tariff)(% loss)(Revenue collection efficiency)

where, DWP = daily water production of 1.35 million m^3
Days = 365 days
Tariff = Average tariff rate of 5.48 pesos/m^3
% loss = percentage loss of water production, ranging from 1% to 18%
Revenue collection efficiency
= (40% of Water Production) x (80% of Billed water)
= 0.32

The results of the computation is given in column (1) of Table 13.3.2. This column represents the loss of water revenue without rehabilitation. Loss of other revenue which is Environmental Charge shown in column (2) is 10% of column (1).

During the period of rehabilitation, loss of water revenue would prevail in the same amount as that of without rehabilitation.for three years. For this reason, loss of revenue in col(7) of Table 13.3.2 through 13.3.4 is shown from 1993 to 1995.

13.3.3 Operation and Maintenance Cost

The operation and maintenance cost was derived from the three year moving average of the operation and maintenance cost.

The operation and maintenance cost (O & M Cost) without rehabilitation is assumed to increase at the rate of 15%, while the corresponding O & M cost with rehabilitation is assumed to increase at the rate of 10%. These assumptions were considered reasonable by the maintenance group of the Balara Plant.

The O & M cost with rehabilitation is then indicated in column (8) of Table 13.3.2 while the O & M cost without rehabilitation is included in columns (3) of Table 13.3.2.

13.3.4 Adjustment Costs of the Rehabilitation Project

There are some adjustment factors associated with each level of rehabilitation. These factors are summarized hereunder. Compared with Level 2, Level 1 requires extra manpower and O&M Cost. While Level 3 requires additional power cost of approximately 15% more than that of Level 1 or Level 2 ((31690-27497)/27497=.15). Level 1 requires additional manpower cost of 5.8% more than that of Level 2 or Level 3 ((54-51)/51=.058).

Level	Chemical Q'ty (kg)	Power Consumption/ (kWh)	Manpower (persons)	Equipment (years)
	(1)	(2)	(3)	(4)
Level 1	65,077	27,497	54	5
Level 2	65,077	27,497	51	15
Level 3	65,077	31,690	51	15

Level	Diff. Manpower Cost (M pesos)	Power Cost (M pesos)	O&M Cost (M pesos)	Diff. in Total Cost (M pesos)
	(5)	(6)	(7)	(8)
Level 1	0.505	0	26.5	0.505 1st -- 20th year 27.05 11th-- 20th year
Level 2	0	0	0	0
Level 3	0	0.28	0	0.28

Level 1 rehabilitation requires an additional cost of 0.5 million pesos between the first year and the 10th year, and of 27.05 million pesos between the 11th year & the 20th year, as indicated in column (15) of Table 13.3.2. Furthermore, additional investment is required in the sixth year. This amount is 236.67 million pesos as shown in column (6). Hence, depreciation cost increases accordingly in column (9).

Level 3 rehabilitation requires an additional cost of 0.279 million pesos due to the increase in power consumption. This figure is included in Column (15) of Table 13.3.4.

13.3.5 Depreciation

A simple straight line method was employed to compute investment in equipment of column (6). This figure is included in column (9).

13.3.6 Interest Payment

The interest of AWCC for the Combination of local and foreign funds was used to generate the annual payment of interest for the period of 20 years. The interest rate for local funds is 15% while that for foreign funds is 2.7%.

13.3.7 Tax

Tax was computed as 35% of net cash flow (water revenue - O & M cost -Depreciation -Interest payment).

13.3.8 Net Cash

Without rehabilitation, the sum of columns (1) through (3), indicated in column (4) is negative. Negative figures are cash outflow. While positive figures are cash inflow in columns (4) and (13).

On the other hand, cash inflow, column (5), minus cash outflow, the sum of columns (6) through (12) is net cash inflow or outflow with rehabilitation. This is shown in column (13). Column (14) is the difference between cash flow with rehabilitation and cash flow without rehabilitation.

13.4 Capital Costs of the Rehabilitation Project

The rehabilitation project has three levels of implementation, corresponding with levels of equipment and material costs. The sources of funds are local and foreign, as indicated below:

	Project Funds		
	(unit:1000pesos)		
	Local Funds	Foreign Funds	Total
Level 1	53,913	231,643	285,556
	(290,583)		(522,226)
Level 2	155,621	531,326	686,947
Level 3	189,930	715,780	905,710

The equipment cost corresponding to each level is taken from the previous chapter as listed below in 1,000 pesos.

Level 1	147,310
	(305,090)
Level 2	335,410
Level 3	446,301

The level 1 project requires additional investment of 236.67 million pesos in 1998 in keeping functional effectiveness as its minimum, and is not intended to upgrade toward level 2. Local investment fund of MWSS is the sum of 147.31 in 1993 and 236.67 in 1998 as shown in column (6) of Table 13.3.2. The equipment cost amounts to 305.09, the sum of the initial equipment cost of 147.31 and 157.78 million pesos.

13.5 Financial Internal Rate of Return (FIRR)

The FIRR for the Rehabilitation project may be summarized as follows:

Level	FIRR (%)
Level 1	7.8
Level 2	5.4
Level 3	0.1

This indicates clearly that Level 1 is the most preferable. The results are shown in the bottom of columns (16) of Tables 13.3.2, 13.3.3 and 13.3.4.

13.6 Sensitivity Analysis

Sensitivity analysis is necessary to assess some significant changes of assumptions underlying FIRR which may adversely affect FIRR.

Any changes of revenue and expenditure may affect the FIRR. The following are assumed:

Scenario 1:
O & M cost with rehabilitation increase at the rate of 15% as indicated in column (8) of Table 13.3.2. This indicates that O & M cost without rehabilitation increases at the same rate as that of O & M cost with rehabilitation.

Scenario 2:
10 % of revenue is lost, as indicated in column (7) of Table 13.3.2.

Scenario 3:
O & M cost of column (8) of Table 13.3.2 increases at the rate of 15 %, and 10 % revenue loss in column (7).

Results found in Table 13.6.1 indicates that FIRR of Level 1 drop from 7.8% to 6.2% in scenario 1, 3.9% in scenario 2, and 1.8% in scenario 3, respectively. On the other hand, FIRR of Level 2 changes from 5.4% to 4.1% in scenario 1, 2.3% in scenario 2, and 0.3% in scenario 3, respectively.

This indicates that FIRR of Level 1 and Level 2 can withstand such adverse effect of other revenue loss and increase in O & M cost. FIRR of Level 3 will not stand against such severe scenario.

13.7 Cash Flow of MWSS

Financial projection for the year 2000, prepared by corporate planning department, October 24, 1991 does not include data beyond year 2000. Therefore, we requested an MWSS Version 2 cash flow statement beginning year 1993 and ending year 2012. Two statements were prepared, one for the cash flow statement with Balara rehabilitation and

the other without rehabilitation. These two statements are reproduced in Tables 13.7.1 and 13.7.2, respectively.

Five items are included in cash inflow. These are (1) collection from water and sewer, (2) foreign loans, (3) Grant + local sources, (4) subsidy for import duties, and (5) the sum of items (1) through (4). On the other hand, six items are included in cash outflow. They are (1) operating expenses, (2) franchise and income taxes, (3) import duties, (4) debt services, (5) capital expenditure, and (6) the sum of items (1) through (5). The difference between total cash inflow and total cash outflow is called net cash flow that is indicated in the last column of Tables 13.7.1 and 13.7.2, respectively.

The format of data is the same for Table 13.7.1 and Table 13.7.2. The differences in cash inflow between the two tables are found in the four items: (1) Collection from water and sewer, (2) foreign loans (3) grant + local sources. The differences in cash outflow between the two tables are found in two items: (1) operating expenses and (2) capital expenditure.

Thus the differences between Tables 13.7.1 and 13.7.2 may be summarized in Table 13.7.3 MWSS cash flow between rehabilitation and without rehabilitation during the period between 1993 and 2012.

Water revenue in column (1) may be interpreted as the net contribution by the Balara project. The amount ranges from 170.11 to 394.24 million pesos.

The project funds are assumed in the amount of in the year 1993 and 1994, while 473 out of 785 million pesos are allocated to capital cost. Net cash is defined as the difference between total income and total expenditure, from 425.57 to 148.39 million pesos.

Table 13.7.3 raises some questions regarding the validity of water revenue and O & M cost. Data on water revenue during the period between 1986 and 1990 reveals that there is not much difference in annual water production. It ranges somewhere between 860 to 909 million cubic meters. The distribution efficiency, defined as the

ratio of water distributed for billing and water production, appears quite stable in the range between 34 to 42% during the period between 1986 and 1990. Furthermore, bill collection efficiency, defined as the amount billed and the amount collected, is between 85 to 98% with an average of 92%.

When the distribution efficiency is multiplied by the bill collection efficiency, the result may be called revenue efficiency. This efficiency ranges somewhere between 30 to 33% for the same period between 1986 and 1990 where the average was 32%.

The Rehabilitation Project is limited to the Balara Plant facilities and does not include any distribution system. Nor does it get involved in any organizational structuring/restructuring, whether it is related to legal, structural, or financial.

Furthermore, the project will not contribute to the increase of water production. The deterioration of the existing equipment may be prevented from further worsening. The level of originally designed production capacity may be restored and be maintained with reduced cost of O & M.

In view of the basic feature of the Rehabilitation Project, it is inconceivable that water revenue may increase approximately from 170 to 394 million pesos. O & M cost relevant to the project may not be justified on the basis of data analysis presented in this chapter.

MWSS cash flow as a whole requires an examination of water revenue and O&M cost under some reasonable assumptions.

The Study Team estimated cash flow in Table 13.7.4. Water revenue is derived from water production multiplied by the average tariff rate of 5.48 pesos/m^3 and further multiplied by revenue efficiency of 32%. The revenue efficiency is the product of water distribution efficiency and billing efficiency as previously indicated.

Data on annual water production between 1991 and 2000 were taken from Financial Projection. In the absence of projected data on water

production beyond year 2000, the same level of water production is assumed beyond year 2000. This is indicated in column (2) of Table 13.7.4.

Operating revenue and other revenue were taken from financial projection. Data from 2001 was assumed to increase at 4% annually, in column (3) and (4).

Total revenue, sum of operating revenue and other revenue, is shown in column (5).

Current expenditure that includes wages and salaries, and O & M cost, interest payment, and other expenses is shown in Column (6). Data for 1991-2000 is taken from financial projection. Data beyond 2000 is projected at the 8% increase per year.

Capital expenditure for 1991-2000 is also taken from Ibid. Data beyond 2000 is projected at the 3.6% increase per year. This is shown in column (7).

Financing requirement in Column (9) is the difference between total revenue and total expenditures. External financing beyond year 2000 was assumed 10% of capital expenditure, and domestic financing, 5% of capital expenditure.

The difference between financing requirement and the sum of external and domestic financing may be called net cash, indicated in column (12). Negative signs are financial outflows, including continuous deterioration.

Under the most realistic assumptions, MWSS cash flow will continue to be negative from 1991 to 2013, except for minor positive cash flows in 1993, 1995, and 1999.

13.8 Summary and Conclusion

Among the three levels of rehabilitation, Level 1 has the highest FIRR at 7.8% while Level 2 and Level 3 have 5.4% and 0.1%, respective-

ly.

Adverse situations affecting the cash flow would not alter the value of FIRR of both Level 1 and Level 2, while FIRR of Level 3 is negative under adverse situations.

Meanwhile Level 1 rehabilitation is recommended. Level 2 rehabilitation is the second choice.

The cash flow of MWSS poses a problem, as indicated in Table 13.7.4 which will be evaluated in Chapter 15.

Table 13.3.1 Selected Indicators between WITH and WITHOUT Rehabilitation

	WITHOUT REHABILITATION			WITH REHABILITATION
Year	Percent Wtr Prod Effc'y (1)	Percent Loss of Wtr Prod (2)	% of Pop Affected Health, Pvt Wtr (3)	% of Pop Affected Health, Pvt Wtr (4)
1993	0.99	0.01	9.3	3
1994	0.98	0.02	9.3	3
1995	0.97	0.03	9.3	3
1996	0.96	0.04	9.3	3
1997	0.95	0.05	9.3	3
1998	0.94	0.06	13.4	3
1999	0.93	0.07	13.4	3
2000	0.92	0.08	13.4	3
2001	0.91	0.09	15.5	3
2002	0.90	0.10	17.6	3
2003	0.90	0.10	17.6	3
2004	0.89	0.11	17.6	3
2005	0.88	0.12	17.6	3
2006	0.87	0.13	17.6	3
2007	0.86	0.14	17.6	3
2008	0.85	0.15	17.6	3
2009	0.84	0.16	17.6	3
2010	0.83	0.17	17.6	3
2011	0.83	0.17	17.6	3
2012	0.82	0.18	17.6	3

Data: Based on a discussion with the operation and maintenance staff staff of MWSS, November 1991.

Column (1) = (1-0.01)^Year.
Column (2) = 1 - column (1).
Column (3) = Data based on local survey of the afftected MWSS population due to low water pressure.
Column (4) = the present affected MWSS population that will remain the same with rehabilitation.

Table 13.3.2 FINANCIAL BENEFITS BETWEEN WITH AND WITHOUT REHABILITATION
LEVEL 1

Year	WITHOUT REHABILITATION: Loss of Wtr Rev (1)	Loss of Other Rev (2)	OM Cost 15% Up (3)	NET CASH (1)to(3) (4)	WITH REHABILITATION: CASH IN Loan/Grant (5)	CASH Invest (6)	OUTFLOW Loss of Revenue (7)	OM Cost 10% Up (8)	Dep (9)	Interest (10)	CASH OUTFLOW Princ'l (11)	Tax (12)	NET CASH IN - OUT (13)	DIFF in NET CASH (13)-(4) (14)	Adjustm't Cost Level 1 (15)	Adjust'd NET CASH (16)
																-285.56
1993	8.66	0.87	1.98	-11.50	285.56	147.31	8.66	1.98	8.84	14.15	8.51	0.00	252.26	263.77	0.50	263.26
1994	17.23	1.72	2.28	-21.23			17.23	2.18	8.84	13.71	8.95	0.00	-42.06	-20.83	0.50	-21.34
1995	25.71	2.57	2.62	-30.91			25.71	2.40	8.84	13.25	9.41	3.43	-54.19	-23.29	0.50	-23.79
1996	34.11	3.41	3.01	-40.54			0.00	2.64	8.84	12.77	9.89	7.44	-32.73	7.81	0.50	7.31
1997	42.43	4.24	3.46	-50.14			0.00	2.90	8.84	12.26	10.40	11.40	-36.96	13.18	0.50	12.68
1998	50.66	5.07	3.98	-59.72		236.67	0.00	3.19	17.68	11.72	10.93	12.24	-274.75	-215.04	0.50	-215.54
1999	58.82	5.88	4.58	-69.28		(157.78)	0.00	3.51	17.68	11.16	11.49	16.13	-42.29	26.99	0.50	26.49
2000	66.89	6.69	5.27	-78.84			0.00	3.86	17.68	10.57	12.08	19.98	-46.49	32.35	0.50	31.85
2001	74.87	7.49	6.06	-88.42			0.00	4.24	17.68	9.95	12.71	23.79	-50.69	37.72	0.50	37.23
2002	82.78	8.28	6.97	-98.03			0.00	4.67	17.68	9.30	13.36	27.56	-54.88	43.15	27.05	16.10
2003	90.61	9.06	8.01	-107.69			0.00	5.14	17.68	8.61	14.05	31.29	-59.08	48.61	27.05	21.56
2004	98.37	9.84	9.22	-117.42			0.00	5.65	17.68	7.89	14.77	34.98	-63.28	54.13	27.05	27.08
2005	106.04	10.60	10.60	-127.24			0.00	6.21	17.68	7.13	15.53	38.63	-67.50	59.74	27.05	32.69
2006	113.64	11.36	12.19	-137.19			0.00	6.84	17.68	6.33	16.33	42.24	-71.73	65.46	27.05	38.41
2007	121.16	12.12	14.02	-147.29			0.00	7.52	17.68	5.49	17.16	45.80	-75.98	71.32	27.05	44.27
2008	128.60	12.86	16.12	-157.58			0.00	8.27	17.68	4.61	18.05	49.32	-80.25	77.34	27.05	50.29
2009	135.98	13.60	18.54	-168.11			0.00	9.10	17.68	3.68	18.97	52.80	-84.55	83.56	27.05	56.51
2010	143.27	14.33	21.32	-178.92			0.00	10.01	17.68	2.71	19.95	56.22	-88.89	90.03	27.05	62.98
2011	150.50	15.05	24.52	-190.06			0.00	11.01	17.68	1.68	20.97	59.60	-93.27	96.80	27.05	69.75
2012	157.65	15.77	28.19	-201.61			0.00	12.11	17.68	0.60	22.05	62.93	-97.70	103.91	27.05	76.86
																0.078

Assumption:
1 Loss of Water Revenue = 1.35*365*5.48*0.32*(0.01)^Year in col (1) where revenue efficiency = 0.32.
2 Other Revenue = 10% of loss of water revenue, col (1).
3 Water production decreases at the rate of 1% compounded annually without rehabilitation.
4 O & M Cost increases at the compounded rate of 15% without rehabilitation and at the rate of 10% with rehabilitation.
5 Net Cash = negative sign indicates that expenditures would be expected. Negative means that the sum of column (1) thru (3) are expeitures without rehabilitation.
6 Depreciation = Straight line method was employed with salvage value of 10% for equipment in column (6).
7 Interest Payment was computed on AWCC. 15% of local funds, and 2.7% of foreign funds.
8 Tax was computed on (total revenue - total expense) multiplied by 35%.
[(12) = { (1)-(8)-(10)-(11) }*0.35]
9 NET CASH(In - Out) = Cash inflow(Loan or grant) - cash outflow, [(5)-(7)-(8)-(10)-(11)-(12)].
For 1998, NET CASH = (5)-(6)-(7)-(8)-(10)-(11)-(12).
10 Difference in Net Cash = Column (13) - column (4).
11 Adjustment Cost for Level 1 = additional cost required for level 1.
Adjustment Cost for Level 2 = 0, and for Level 3 =0.279 million pesos.
12 FIRR = Financial Internal Rate of Return.
13 Top figure of column (16) = - column (5). Loan or grant and project initiation are assumed to cover two accounting years.
14 (157.78) in col (6) is equipment cost while 236.67 is the cost of equipment plus installation. Additional amount of 236.67 million pesos as local funds is required in keeping functional effectiveness at its minimum, and is not intended to upgrade level 1 toward level 2. See also Table 16.1.2 and Note: 1 through 4.

Table 13.3.3 FINANCIAL BENEFITS BETWEEN WITH AND WITHOUT REHABILITATION
LEVEL 2

	WITHOUT REHABILITATION				WITH REHABILITATION											
					CASH IN	CASH	OUTFLOW			CASH	OUTFLOW			DIFF in	Adj'd	Adjust'd
Year	Loss of Wtr Rev (1)	Loss of Oth Rev (2)	OM Cost 15% Up (3)	Net Cash (1)to(3) (4)	Loan/Grant (5)	Invest (6)	Loss of Wtr Rev (7)	OM Cost 10% Up (8)	Dep (9)	Int't (10)	Princ'l (11)	Tax (12)	NET CASH IN - OUT (13)	NET CASH (13)-(4) (14)	Cost Level 2 (15)	NET CASH (16)
																-686.95
1993	8.66	0.87	1.98	-11.50	686.95	336.58	8.66	1.98	20.19	37.21	19.44	0.00	619.66	631.17	0.00	631.17
1994	17.23	1.72	2.28	-21.23			17.23	2.18	20.19	36.11	20.53	0.00	-76.05	-54.82	0.00	-54.82
1995	25.71	2.57	2.62	-30.91			25.71	2.40	20.19	34.96	21.69	0.00	-84.75	-53.84	0.00	-53.84
1996	34.11	3.41	3.01	-40.54			0.00	2.64	20.19	33.74	22.91	0.00	-59.28	-18.74	0.00	-18.74
1997	42.43	4.24	3.46	-50.14			0.00	2.90	20.19	32.45	24.19	0.36	-59.90	-9.76	0.00	-9.76
1998	50.66	5.07	3.98	-59.72			0.00	3.19	20.19	31.09	25.56	4.58	-64.41	-4.69	0.00	-4.69
1999	58.82	5.88	4.58	-69.28			0.00	3.51	20.19	29.65	26.99	8.77	-68.92	0.36	0.00	0.36
2000	66.89	6.69	5.27	-78.84			0.00	3.86	20.19	28.13	28.51	12.95	-73.45	5.39	0.00	5.39
2001	74.87	7.49	6.06	-88.42			0.00	4.24	20.19	26.52	30.12	17.10	-77.99	10.43	0.00	10.43
2002	82.78	8.28	6.97	-98.03			0.00	4.67	20.19	24.83	31.81	21.24	-82.55	15.48	0.00	15.48
2003	90.61	9.06	8.01	-107.69			0.00	5.14	20.19	23.04	33.60	25.36	-87.13	20.56	0.00	20.56
2004	98.37	9.84	9.22	-117.42			0.00	5.65	20.19	21.15	35.49	29.46	-91.75	25.67	0.00	25.67
2005	106.04	10.60	10.60	-127.24			0.00	6.21	20.19	19.15	37.49	33.54	-96.39	30.85	0.00	30.85
2006	113.64	11.36	12.19	-137.19			0.00	6.84	20.19	17.04	39.60	37.60	-101.98	36.11	0.00	36.11
2007	121.16	12.12	14.02	-147.29			0.00	7.52	20.19	14.82	41.83	41.66	-105.82	41.47	0.00	41.47
2008	128.60	12.86	16.12	-157.58			0.00	8.27	20.19	12.46	44.18	45.69	-110.60	46.98	0.00	46.98
2009	135.98	13.60	18.54	-168.11			0.00	9.10	20.19	9.98	46.67	49.71	-115.45	52.66	0.00	52.66
2010	143.27	14.33	21.32	-178.92			0.00	10.01	20.19	7.35	49.29	53.72	-120.37	58.55	0.00	58.55
2011	150.50	15.05	24.52	-190.06			0.00	11.01	20.19	4.58	52.06	57.71	-125.36	64.70	0.90	64.70
2012	157.65	15.77	28.19	-201.61			0.00	12.11	20.19	1.65	54.99	61.69	-130.44	71.17	0.00	71.17

Assumptions: See Assumptions 1 through 13 of Table 13.3.2.
There is no adjustment factor for level 2.

0.054

Table 13.3.4 FINANCIAL BENEFITS BETWEEN WITH AND WITHOUT REHABILITATION
LEVEL 3

Year	WITHOUT REHABILITATION: Loss of Wtr Rev (1)	Loss of Oth Rev (2)	OM Cost 15% Up (3)	Net Cash (1)to(3) (4)	CASH IN: Loan/Grant (5)	CASH Invest (6)	WITH REHABILITATION: OUTFLOW: Loss of Revenue (7)	OM Cost 10% Up (8)	Dep (9)	Int't (10)	CASH OUTFLOW: Princ'l (11)	Tax (12)	NET CASH IN - OUT (13)	DIFF in NET CASH (13)-(4) (14)	Adj't Cost Level 3 (15)	Adj't NET CASH (16)
																-905.71
1993	8.66	0.87	1.98	-11.50	905.71	446.30	8.66	1.98	26.78	47.19	26.23	0.00	821.65	833.16	0.28	832.88
1994	17.23	1.72	2.28	-21.23			17.23	2.18	26.78	45.77	27.65	0.00	-92.82	-71.59	0.28	-71.87
1995	25.71	2.57	2.62	-30.91			25.71	2.40	26.78	44.27	29.14	0.00	-101.52	-70.62	0.28	-70.89
1996	34.11	3.41	3.01	-40.54			0.00	2.64	26.78	42.70	30.72	0.00	-76.05	-35.51	0.28	-35.79
1997	42.43	4.24	3.46	-50.14			0.00	2.90	26.78	41.03	32.38	0.00	-76.31	-26.17	0.28	-26.45
1998	50.66	5.07	3.98	-59.72			0.00	3.19	26.78	39.28	34.13	0.00	-76.60	-16.89	0.28	-17.17
1999	58.82	5.88	4.58	-69.28			0.00	3.51	26.78	37.44	35.98	3.74	-80.67	-11.39	0.28	-11.67
2000	66.89	6.69	5.27	-78.84			0.00	3.86	26.78	35.49	37.92	8.07	-85.34	-6.50	0.28	-6.78
2001	74.87	7.49	6.06	-88.42			0.00	4.24	26.78	33.44	39.98	12.38	-90.04	-1.62	0.28	-1.90
2002	82.76	8.28	6.97	-98.03			0.00	4.67	26.78	31.28	42.14	16.68	-94.76	3.27	0.28	2.99
2003	90.61	9.06	8.01	-107.69			0.00	5.14	26.78	29.00	44.42	20.97	-99.52	8.17	0.28	7.89
2004	98.37	9.84	9.22	-117.42			0.00	5.65	26.78	26.60	46.82	25.25	-104.31	13.11	0.28	12.83
2005	106.04	10.60	10.60	-127.24			0.00	6.21	26.78	24.06	49.35	29.52	-109.14	18.10	0.28	17.82
2006	113.64	11.36	12.19	-137.19			0.00	6.84	26.78	21.39	52.02	33.78	-114.03	23.16	0.28	22.88
2007	121.16	12.12	14.02	-147.29			0.00	7.52	26.78	18.58	54.83	38.03	-118.97	28.32	0.28	28.04
2008	128.60	12.86	16.12	-157.58			0.00	8.27	26.78	15.61	57.80	42.28	-123.97	33.61	0.28	33.34
2009	135.98	13.60	18.54	-168.11			0.00	9.10	26.78	12.49	60.93	46.53	-129.04	39.07	0.28	38.79
2010	143.27	14.33	21.32	-178.92			0.00	10.01	26.78	9.19	64.22	50.77	-134.19	44.73	0.28	44.45
2011	150.50	15.05	24.52	-190.06			0.00	11.01	26.78	5.72	67.70	55.01	-139.43	50.63	0.28	50.36
2012	157.65	15.77	28.19	-201.61			0.00	12.11	26.78	2.06	71.36	59.24	-144.76	56.84	0.28	56.57

Assumption: See Assumptions 1 through 13 of Table 13.3.2.
Adjustment factor for level 3 is column (15). 0.0001

Table 13.6.1 FINANCIAL SENSITIVITY ANALYSIS

SCENARIO	DESCRIPTION	FIRR(%)		
		Level 1	Level 2	Level 3
0	Tables 13.3.2 thru 13.3.4	7.8	5.4	0.1
1	O & M Cost: rate of increase of column (8)= 15%	6.2	4.1	-1.9
2	Loss of Revenue: 10% of [column (1)+ column (2)] for 1996-2012	3.9	2.3	-4.2
3	O & M Cost: rate of increase of column (8)= 15% and Loss of Revenue: 10% of [column (1)+ column (2)] for 1996-2012	1.8	0.3	-7.9

Explanation:1 Data from Table 13.3.2.
2 The rate of increase of O & M Cost is the compounded rate te annually.

Table 13.7.1 MWSS CASH FLOW STATEMENT WITH BWTP PROJECT

CASH FLOW STATEMENT
(In Million Pesos)

YEAR	CASH PROVIDED BY : COLLECTION FROM WATER & SEWER	REHAB REVENUE	FOREIGN LOANS	REHAB LOANS	GRANT + LOCAL SOURCES	REHAB LOCAL	IMPORT DUTIES	REHAB IMPORT DUTIES	TOTAL
1993	4344.890		2185.820		2358.95		394.940		9284.600
1994	4995.650		2248.560		814.32		321.650		8380.180
1995	5761.510		1882.120		273.11		262.400		8179.140
1996	6757.270		951.250		74.96		217.070		8000.550
1997	7536.420		2097.200		5.78		391.060		10030.460
1998	8072.270		1921.580		5.55		369.500		10368.900
1999	8563.430		1285.480		5.23		246.080		10100.220
2000	8909.290		1624.420		7.36		400.240		10941.310
2001	9255.150		854.195				225.305		10144.650
2002	9601.010		1868.722				567.180		12036.912
2003	9946.870		2282.411				707.830		12937.111
2004	10292.730		2731.444				960.214		13984.388
2005	10638.590		1198.484				503.812		12340.886
2006	10984.450		0.000				44.058		11028.508
2007	11330.310		0.000				47.583		11377.893
2008	11676.170		0.000				51.389		11727.559
2009	12022.030		0.000				55.500		12077.530
2010	12367.890		0.000				59.940		12427.830
2011	12713.750		0.000				64.736		12778.486
2012	13059.610		0.000				69.914		13129.524

SCHEME I
WITH BWTPRP

CASH APPLIED TO : OPERATING EXPENSES	REHAB O & M COST	FRANCHIZE & INCOME TAXES	REHAB TAXES	IMPORT DUTIES	REHAB IMPORT DUTIES	DEBT SERVICE	REHAB DEBT SERVICE	CAPITAL EXPENDITURE	REHAB CAPITAL EXPENDITURE	TOTAL	NET CASH FLOW
1744.230		598.390		394.940		2396.570		3949.450		9083.580	201.020
1938.170		731.140		321.650		2777.730		3216.520		8980.210	-600.030
2239.130		649.430		262.400		2802.040		2624.050		8777.050	-597.910
2479.040		956.520		217.070		3074.820		2170.700		8898.150	-897.600
2754.520		1115.760		391.060		2748.960		3910.620		10920.920	-890.460
3057.280		1151.190		369.500		2551.240		3694.990		10824.200	-455.300
3394.640		1183.560		246.080		2239.580		2460.750		9524.610	575.610
3759.980		1163.770		400.240		2018.350		4002.360		11344.700	-403.390
4125.320		842.548		225.305		1807.060		2253.048		9253.280	891.370
4490.660		874.033		567.180		1648.910		5671.803		13252.586	-1215.674
4856.000		905.519		707.830		1587.110		7078.308		15134.766	-2197.655
5221.340		937.004		960.214		1558.420		9602.156		18279.134	-4294.746
5586.680		968.490		503.812		1565.640		5038.128		13662.750	-1321.864
5952.020		999.975		44.058		1887.490		440.580		9324.123	1704.385
6317.360		1031.461		47.583		1641.220		475.826		9513.450	1864.443
6682.700		1062.947		51.389		1394.950		513.892		9705.878	2021.681
7048.040		1094.432		55.500		1148.680		555.004		9901.656	2175.874
7413.380		1125.918		59.940		902.410		599.404		10101.052	2326.778
7778.720		1157.403		64.736		656.140		647.356		10304.355	2474.131
8144.060		1188.889		69.914		409.870		699.145		10511.878	2617.647

Table 13.7.2 MWSS CASH FLOW STATEMENT WITHOUT BWTP PROJECT

CASH FLOW STATEMENT
(In Million Pesos)

SCHEME I
WITHOUT BWTPRP

YEAR	CASH PROVIDED BY : COLLECTION FROM WATER & SEWER	FOREIGN LOANS	LOCAL SOURCES	IMPORT DUTIES	TOTAL
1993	4174.780	2185.820	1798.95	394.940	8554.490
1994	4825.540	2248.560	589.32	321.650	7985.070
1995	5591.400	1882.120	273.11	252.400	8009.030
1996	6587.160	951.250	74.96	217.070	7830.440
1997	7366.310	2097.200	5.78	391.060	9860.350
1998	7791.440	1921.580	5.55	369.500	10088.070
1999	8282.600	1285.480	5.23	246.080	9819.390
2000	8628.460	1624.420	7.36	400.240	10660.480
2001	8917.620	664.195		225.305	9807.120
2002	9206.770	1868.722		567.180	11642.672
2003	9552.630	2282.411		707.830	12542.871
2004	9898.450	2731.444		960.214	13590.148
2005	10244.350	1198.484		503.812	11946.646
2006	10590.210	0.000		44.058	10634.268
2007	10936.070	0.000		47.583	10983.653
2008	11281.930	0.000		51.389	11333.319
2009	11627.790	0.000		55.500	11683.290
2010	11973.650	0.000		59.940	12033.590
2011	12319.510	0.000		64.736	12384.246
2012	12665.370	0.000		69.914	12735.284

CASH APPLIED TO : OPERATING EXPENSES	FRANCHIZE & INCOME TAXES	IMPORT DUTIES	DEBT SERVICE	CAPITAL EXPENDITURE	TOTAL	NET CASH FLOW
1575.940	598.390	394.940	2396.570	3713.200	8779.040	-224.550
1867.342	731.140	321.650	2777.730	2980.270	8678.132	-693.062
2173.019	849.430	252.400	2802.040	2624.050	8710.939	-701.909
2416.632	956.520	217.070	3074.820	2170.700	8835.742	-1005.302
2692.346	1115.760	391.060	2748.960	3910.620	10858.746	-998.396
2950.919	1151.190	369.500	2551.240	3694.990	10717.839	-629.769
3283.316	1183.560	246.080	2239.580	2460.750	9413.286	406.104
3641.462	1163.770	400.240	2018.350	4002.360	11226.182	-565.702
3974.872	837.387	225.305	1807.060	2253.048	9097.671	709.449
4306.263	864.538	567.180	1648.910	5671.803	13058.694	-1416.023
4663.534	897.016	707.830	1587.110	7078.308	14933.798	-2390.927
5021.348	929.493	960.214	1558.420	9602.156	18071.631	-4481.483
5379.651	961.970	503.812	1565.640	5038.128	13449.201	-1502.555
5738.398	994.447	44.058	1887.490	1440.580	10104.972	529.296
6097.546	1026.924	47.583	1641.220	1555.826	10369.099	614.553
6457.062	1059.401	51.389	1394.950	1680.292	10643.095	690.225
6816.913	1091.878	55.500	1148.680	1814.716	10927.687	755.603
7177.070	1124.355	59.940	902.410	1959.893	11223.669	809.921
7537.510	1156.832	64.736	656.140	2116.684	11531.902	852.343
7898.209	1189.310	69.914	409.870	2286.019	11853.322	881.962

Table 13.7.3 MWSS CASH FLOW BETWEEN WITH AND WITHOUT REHABILITAYION (M PESOS)

Year	Water Revenue (1)	Local Funds (2)	Total Income (3)	OM Cost (4)	Cap Exp (5)	Total Exp (6)	Net Cash (7)
1993	170.11	560.00	730.11	68.29	236.25	304.54	425.57
1994	170.11	225.00	395.11	65.83	236.25	302.08	93.03
1995	170.11	0.00	170.11	66.11	0.00	66.11	104.00
1996	170.11	0.00	170.11	62.41	0.00	62.41	107.70
1997	170.11	0.00	170.11	62.17	0.00	62.17	107.94
1998	280.83	0.00	280.83	106.36	0.00	106.36	174.47
1999	280.83	0.00	280.83	111.32	0.00	111.32	169.51
2000	280.83	0.00	280.83	118.52	0.00	118.52	162.31
2001	337.53	0.00	337.53	150.45	0.00	150.45	187.08
2002	394.24	0.00	394.24	184.40	0.00	184.40	209.84
2003	394.24	0.00	394.24	192.47	0.00	192.47	201.77
2004	394.24	0.00	394.24	199.99	0.00	199.99	194.25
2005	394.24	0.00	394.24	207.03	0.00	207.03	187.21
2006	394.24	0.00	394.24	213.62	0.00	213.62	180.62
2007	394.24	0.00	394.24	219.81	0.00	219.81	174.43
2008	394.24	0.00	394.24	225.64	0.00	225.64	168.60
2009	394.24	0.00	394.24	231.13	0.00	231.13	163.11
2010	394.24	0.00	394.24	236.31	0.00	236.31	157.93
2011	394.24	0.00	394.24	241.21	0.00	241.21	153.03
2012	394.24	0.00	394.24	245.85	0.00	245.85	148.39

Water Revenue = Difference in Revenue Collection from Water & Sewerage between with Rehabilitation and without Rehabilitation
Local Funds = Subsidy from the local sources
Total Income = Water Revenue + Local Funds
OM Cost = Difference in Operating Expenses between with Rehabilitation and without Rehabilitation
Capital Exp = Capital Expenditure
Total Expense = O & M Cost + Capital Expenditure
Net Cash = Total Income - Total Expense

Data Source: MWSS Cash Flow Statement, Nov. 7,. 1991.
With and Without Rehabilitation, Corporate Planning Dept.

Table 13.7.4 JICA STUDY TEAM ESTIMATES OF MWSS CASH FLOW
ATTRIBUTABLE TO BALARA REHABILITATION PROJECT
(Unit: Million Pesos except col. (2))

Year	Water Prod'tn M m^3	Operating Revenue 4% Inc Fm 2000	Other Revenue	Total Revenue (3)+(4)	Current Exp 8% Inc Fm 2000	Capital Exp 3.6% Inc Fm 2000	Total Exp (6)+(7)	Financing Requirem't (5)-(8)	External Finance 10% Cap Exp fm 2000	Domestic Finance 5% Cap Exp fm 2000	Net Cash (9)-(10)-(11)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1990	943.00										
1991	849.49	2879.82	518.17	3397.99	2578.59	3380.80	5959.39	-2561.40	711.75	1099.26	-750.39
1992	1026.20	4400.93	477.66	4878.59	3409.40	4883.34	8292.74	-3414.15	1381.04	1859.45	-173.66
1993	1173.15	4934.70	586.64	5521.34	3712.63	3979.61	7692.24	-2170.90	1689.24	482.15	0.49
1994	1176.90	5564.78	438.59	6003.37	4083.29	3659.71	7743.00	-1739.63	1850.02	-264.49	-154.10
1995	1182.72	6413.59	399.58	6813.17	4498.64	3196.80	7695.44	-882.27	1106.42	-220.15	4.00
1996	1188.17	7553.67	293.77	7847.44	5177.36	2387.77	7565.13	282.31	-344.41	-309.27	-371.37
1997	1218.63	8488.67	435.43	8924.10	5559.94	4292.16	9852.10	-928.00	521.67	-90.25	-496.58
1998	1250.88	9167.04	383.48	9550.52	5928.50	4064.50	9993.00	-442.48	281.95	-55.31	-215.84
1999	1283.01	9840.67	323.63	10164.30	6297.32	3502.39	9799.71	364.59	-243.42	-26.56	94.61
2000	1287.70	10699.03	415.51	11114.54	6743.07	6985.82	13728.89	-2614.35	-98.61	-8.00	-2720.96
2001	1287.70	11251.40	436.55	11687.96	7282.52	7544.69	14827.20	-3139.24	754.47	377.23	-2007.54
2002	1287.70	11701.46	454.02	12155.48	7865.12	8148.26	16013.38	-3857.90	814.83	407.41	-2635.66
2003	1287.70	12169.52	472.18	12641.70	8494.33	8800.12	17294.45	-4652.75	880.01	440.01	-3332.73
2004	1287.70	12656.30	491.06	13147.36	9173.87	9504.13	18678.00	-5530.64	950.41	475.21	-4105.02
2005	1287.70	13162.55	510.71	13673.26	9907.78	10264.46	20172.24	-6498.99	1026.45	513.22	-4959.32
2006	1287.70	13689.05	531.14	14220.19	10700.40	11085.62	21786.02	-7565.83	1108.56	554.28	-5902.99
2007	1287.70	14236.62	552.38	14789.00	11556.44	11972.47	23528.91	-8739.91	1197.25	598.62	-6944.04
2008	1287.70	14806.08	574.48	15380.56	12480.95	12930.27	25411.22	-10030.66	1293.03	646.51	-8091.12
2009	1287.70	15398.32	597.45	15995.78	13479.43	13964.69	27444.12	-11448.34	1396.47	698.23	-9353.63
2010	1287.70	16014.26	621.35	16635.61	14557.78	15081.86	29639.64	-13004.04	1508.19	754.09	-10741.76
2011	1287.70	16654.83	646.21	17301.03	15722.40	16288.41	32010.82	-14709.78	1628.84	814.42	-12266.52
2012	1287.70	17321.02	672.06	17993.08	16980.20	17591.48	34571.68	-16578.61	1759.15	879.57	-13939.88
2013	1287.70	18013.86	698.94	18712.80	18338.61	18998.80	37337.42	-18624.62	1899.88	949.94	-15774.80

Assumptions:

1 Data from 1991-2000 were taken from Financial Projection, Corp Planning Dept, MWSS, Feb 6, 1992.
2 Data from 2001 to 2013 were estimated by JICA Study Team.
3 Water Production beyond year 2000 is assumed to remain the same level of year 2000.
4 Water Revenue = Water Production * Tariff * Revenue Efficiency.
Operating Revenue = Water Revenue + Operation Revenue.
5 Revenue Efficiency = Water Distribution Efficiency * Billing Efficiency, 0.624 from year 2001 and beyond.
Operating Revenue = Col (1)*11.22*0.624*1.2*1.04 where 11.22 = revenue tariff, 0.624 = revenue efficiency, 1.2 = revenue increasing factor, and 1.04 = rate of tariff increase of 4%.
6 Total Revenue = Operating Revenue + Other Revenue, where Other Revenue = Operating Revenue * 0.0388.
7 Current and Capital Expenditure for 2001-2013 increase at 8% and 3.6% respectively.
Col (6) of year 2001 = [col(6) of year 2000] * 1.08.
Col (7) of year 2001 = [col(7) of year 2000] * 1.036.
8 Total Expenditure = Current + Capital Expenditures.
9 Financing Requirement = column (5) - (8).
10 External Financing = 10% of Capital Expenditure from year 2001 and beyond.
11 Domestic Financing = 5% of Capital Expenditure from year 2001 and beyond.
12 Net Cash = Column (9) - (10) - (11).

CHAPTER 14 ECONOMIC ANALYSIS

This chapter presents the economic benefits to be derived from the Rehabilitation of the Balara Plant. The EIRR was computed, sensitivity analysis performed and summary and conclusions prepared.

Level 2 is considered as the base adjusting cost factors of Level 1 and Level 2.

14.1 General

The economic analysis is centered on the rehabilitation benefits & costs and the assessment of the net contribution to the economic and social welfare of the population served by the Balara water system.

The objective of economic evaluation is to determine the difference in net benefits between with rehabilitation and without rehabilitation. The rehabilitation costs are estimated on the basis of the rehabilitation level. Three levels of rehabilitation will be considered.

The criterion that is most frequently used in the evaluation of development projects is the economic internal rate of return (EIRR), the concept of obtaining the economic benefits with available resources. The economic evaluation provides the justifiable, useful, and practical yardstick to determine the economic merits and demerits of a project and the most important criterion in project feasibility.

14.2 Economic Benefits

The net economic benefits are derived from the difference in cost benefits between with rehabilitation and without rehabilitation. Total cost without rehabilitation includes: (1) operation and maintenance cost, (2) loss of water revenue, (3) loss of other revenue; (4) cost of private water; and (5) health cost.

On the other hand, total cost with rehabilitation consists of: (1) operation and maintenance cost, (2) loss of revenue, (3) cost of

private water, and (4) health cost.

Without rehabilitation the sum of five items as indicated in column (6) of Table 14.2.1 shall be considered. On the other hand, with rehabilitation, the sum of four items that is shown in column (11) shall be considered. The difference between column (6) and column (11) is the net economic benefits attributable to the Balara Rehabilitation Project and to the population served by the Project. Negative figures of columns (6) and (11) are cash outflow.

The net economic benefits, as shown in column (12) is based on Level 2 of the rehabilitation project. There are some differences in operation and maintenance cost between Level 1 and Level 3. These differences are reflected as additional cost to Level 1 and to Level 3, as indicated in column (13) and column (14) respectively. Net economic benefits, adjusted to each level, are reproduced in columns (15) through (17) for Level 1 through Level 3, respectively.

14.3 Items of Economic Benefits

A brief description of each of the cost items to be considered in the analysis of Economic Benefits are presented in Table 14.2.1 and will be discussed in the following subsections. Efficiency of Equipment, Loss of Water Revenue, Operation and Maintenance Cost and Adjustment Cost of the Rehabilitation Project shall not be discussed and shall be referred to Sections 13.3.1, 13.3.2, 13.3.3 and 13.3.4, respectively.

During the period of rehabilitation, loss of water revenue would prevail in the same amount as that of without rehabilitation. For this reason, loss of revenue in column (8) of Table 14.2.1 is indicated from 1993 to 1995.

14.3.1 Cost of Private Water

At present, 3 percent of the population served by MWSS could not get water due to low pressure. Residents in the affected area depend on private water at a cost 5 times higher than that of MWSS water.

However, their consumption of water is approximately one-fifth of that of the regular family under the MWSS. An extensive survey on the water problem in the affected area made it possible to estimate the extent of private burden related to water supply.

At full normal production of water, only three percent of the population is served by the MWSS. Others have to rely on private water which costs ₱25 per cubic meter.

Under the MWSS, water is sold at the average tariff rate of 5.48 pesos/m^3. However, the consumption of water in the low water pressure area is approximately one fifth of that of the average from family household (30 m^3 compared with 6 m^3 a month)

The cost of private water on the basis of the above information is computed as follows:

(WP)(Days)(% Pop)(P) = 73.91 million pesos

where,

WP = 1.35 million cubic meter water production daily
Days = 365 days a year
% Pop = 3% of the MWSS served population affected by low pressure
P = 25 pesos/m^3, private costs borne by the affected residents, multiplied by one fifth of consumption of water = 25 x 1/5 = 5 pesos/m^3

This cost is indicated in column (9) of table 14.2.1, as the cost of private water with rehabilitation.

On the other hand, the comparable cost of water without rehabilitating the plant is based on the percentage of affected MWSS population. The percentage increases from 9.3 in the first year to 17.6 in the 20th year, the figure derived from the percentage of population affected in column (3) of Table 13.3.1. The results are shown in column (4) of Table 14.2.1. This cost indicates the cost of private water without rehabilitation.

14.3.2 Health Cost

The economic loss to society due to the reduction of water supply is estimated. Quantification of health cost is determined through the direct relationship between safe water supply and improved health. For the purpose of this study, health cost is quantified, taking three factors into consideration: cost of time lost due to illness, income lost due to premature death, and cost of medical expenses.

It is expressed as the sum of three factors:

$$\text{Health cost} = (C_1 + C_2 + C_3)(.73)(PS) = 3.60 \text{ million pesos}$$

Where,

- C_1 = illness cost = (EAP)(MB)(W)(D)
- C_2 = death cost = (EAP)(MT)(DC)
- C_3 = medical cost = (EAP)(MB)(MC)
- .73 = 73% of ($C_1 + C_2 + C_3$) is attributable to this project
- PS = 3% population served by MWSS, 3% of 5.155 million persons, 0.15465 million persons will be affected with rehabilitation. Without rehabilitation, 9.3% to 17.6% population will be affected.
- EAP = economically active population, 41.09%
- W = weighted average wage rate per day, in Metro Manila workers, 117 pesos
- D = number of days per year lost due to illness and such workers are unable to work, 8 days
- MB = morbidity rate, 1.24%
- MT = mortality rate, 0.0165%
- DC = economic loss due to premature death, 137,280 pesos
- MC = average medical expenses, 3,500 pesos

Actual data are derived from Water Project 2000, "Health Benefits of Metropolitan Waterworks and Sewerage System", and from a discussion with Public Health Officials, in Metro Manila, 1991.

Health Cost is estimated at 3.60 million pesos per year, provided that in the area with low water pressure, three percent of the MWSS

population rely on private water. This condition is assumed to last for the project period of 20 years, as indicated in column (10) of Table 14.2.1. This is the health cost with rehabilitation.

On the other hand, the same cost increases due to the expected loss of water supply from 9.3% in the first year to 17.6% in the 20th year, as shown in column (3) of Table 13.3.1. The corresponding increase of health cost will range from 7.65 in the first year to 17.53 million pesos in the 20th year. This is shown in column (5) of Table 14.2.1. This is the health cost without rehabilitation.

14.4 Capital Cost of the Rehabilitation Project

Capital Cost of the Rehabilitation Project are discussed in Section 13.4.

14.5 Items not Included in the Rehabilitation Project

A water supply project usually includes economic benefits attributable to the reduction of fire damage as stated in the final report on Angat Water Supply Optimization Project (June 1988) and a recent report on Cavite Water Supply Project.

However, the proposed Balara Rehabilitation Project is neither related to the installation of additional hydrants nor related to the improvements of the water distribution. Hence such eccnomic benefits are not included in this Chapter.

Land value is another item which may be considered in economic benefits. It is pointed out that land values are not directly affected by rehabilitation of the plant and shall not be considered.

Other indirect benefits may include employment generation through the employment multiplier effect for domestic economic activities, and income generation through the income multiplier effect. Again, the Rehabilitation Project, in which the multiplier effect may be present, does not have a large impact upon the local economy as a whole. For this reason, indirect benefits are not estimated as a

part of economic benefits.

14.6 Economic Internal Rate of Return (EIRR)

The EIRR for the Rehabilitation Project may be summarized as follows:

	EIRR (%)	Project Cost (M pesos)
Level 1	63.8	286
Level 2	32.4	687
Level 3	26.3	906

This indicates unmistakably that Level 1 is most preferable choice. The results are shown in the bottom of columns (18) through (20) of Table 14.2.1. The social discount rate of 15% was used to generate the present value of net economic benefits.

14.7 Sensitivity Analysis

Sensitivity analysis is focused upon adverse situations significantly affecting EIRR. Any changes of water revenue, of health cost, and of cost of private water may affect the EIRR. Three scenarios assumed for the sensitivity analysis are:

Scenario 1:
Health cost and cost of private water are increased by 10%.

Scenario 2:
Loss of revenue increases by 10%.

Scenario 3:
Health cost and loss of private water both are increased by 10%, and loss of revenue also by 10%.

A summary of the results is presented in Table 14.7.1. EIRR of Level 1 drops from 63.8% to 61.6% in Scenario 1, 63.5% in Scenario 2, and 61.3% in Scenario 3, respectively. On the other hand, EIRR of Level 2 changes from 32.4% to 31.6% in Scenario 1, 32.1% in Scenario 2, and

31.3% in Scenario 3, respectively. EIRR of Level 3 also changes from 26.3% to 25.4% in Scenario 3.

This indicates that EIRR of Level 1, Level 2, and Level 3 will stand the most severe impact of 10% increase of health cost and the cost of private water and of 10% loss of revenue.

14.8 Summary of Conclusion

Based on economic considerations, it may be concluded that Level 1 Rehabilitation is most preferable. This conclusion will not be altered by sensitivity analysis. Even if some adversely affecting situations might occur, Level 1, Level 2, and Level 3 could stand against the worst situations and yet could yield the high return to justify the project.

Table 14.2.1 ECONOMIC BENEFITS BETWEEN WITH AND WITHOUT REHABILITATION

	WITHOUT REHABILITATION (UNIT: M PESO)						WITH REHABILITATION (UNIT: M PESO)								EIRR		
Year	OM Cost (1)	Loss of Wtr Rev (2)	Loss of Oth Rev (3)	Cost of Pvt Wtr (4)	Health Cost (5)	Net Cash (1)to(5) (6)	OM Cost (7)	Loss of Revenue (8)	Cost of Pvt Wtr (9)	Health Cost (10)	Net Cash (7)to(10) (11)	Diff (11)-(6) (12)	Level 1 Cost (13)	Level 3 Cost (14)	Level 1 (12)-(13) (15)	Level 2 (12) (16)	Level 3 (12)-(14) (17)
1993	1.98	8.66	0.87	229.13	7.65	-248.28	1.98	8.66	73.91	3.60	-88.15	160.13	0.505	0.28	-285.56	-686.95	-905.71
1994	2.28	17.23	1.72	229.13	7.65	-258.01	2.18	17.23	73.91	3.60	-96.92	161.09	0.505	0.28	159.62	160.13	159.85
1995	2.62	25.71	2.57	229.13	7.65	-267.68	2.40	25.71	73.91	3.60	-105.63	162.06	0.505	0.28	160.58	161.09	160.81
1996	3.01	34.11	3.41	229.13	7.65	-277.32	2.64	0.00	73.91	3.60	-80.15	197.17	0.505	0.28	161.55	162.06	161.78
1997	3.46	42.43	4.24	229.13	7.65	-286.92	2.90	0.00	73.91	3.60	-80.41	206.50	0.505	0.28	196.66	197.17	196.89
1998	3.98	50.66	5.07	330.14	12.49	-402.35	3.19	0.00	73.91	3.60	-80.70	321.64	0.505	0.28	206.00	206.50	206.22
1999	4.58	58.82	5.88	330.14	12.49	-411.91	3.51	0.00	73.91	3.60	-81.02	330.89	0.505	0.28	321.14	321.64	321.36
2000	5.27	66.89	6.69	330.14	12.49	-421.47	3.86	0.00	73.91	3.60	-81.37	340.10	0.505	0.28	330.38	330.89	330.61
2001	6.06	74.87	7.49	381.88	15.01	-485.31	4.25	0.00	73.91	3.60	-81.76	403.55	0.505	0.28	339.59	340.10	339.82
2002	6.97	82.78	8.28	433.62	17.53	-549.18	4.67	0.00	73.91	3.60	-82.19	467.00	0.505	0.28	403.05	403.55	403.27
2003	8.01	90.61	9.06	433.62	17.53	-558.84	4.67	0.00	73.91	3.60	-82.19	476.66	27.05	0.28	466.49	467.00	466.72
2004	9.22	98.37	9.84	433.62	17.53	-568.57	5.65	0.00	73.91	3.60	-83.17	485.40	27.05	0.28	449.61	476.66	476.38
2005	10.60	106.04	10.60	433.62	17.53	-578.39	6.22	0.00	73.91	3.60	-83.73	494.66	27.05	0.28	458.35	485.40	485.12
2006	12.19	113.64	11.36	433.62	17.53	-588.34	6.84	0.00	73.91	3.60	-84.35	503.99	27.05	0.28	467.61	494.66	494.38
2007	14.02	121.16	12.12	433.62	17.53	-598.44	7.52	0.00	73.91	3.60	-85.04	513.41	27.05	0.28	476.94	503.99	503.71
2008	16.12	128.60	12.86	433.62	17.53	-608.74	8.28	0.00	73.91	3.60	-85.79	522.95	27.05	0.28	486.36	513.41	513.13
2009	18.54	135.98	13.60	433.62	17.53	-619.26	9.10	0.00	73.91	3.60	-86.62	532.65	27.05	0.28	495.90	522.95	522.67
2010	21.32	143.27	14.33	433.62	17.53	-630.07	10.01	0.00	73.91	3.60	-87.53	542.55	27.05	0.28	505.60	532.65	532.37
2011	24.52	150.50	15.05	433.62	17.53	-641.22	11.01	0.00	73.91	3.60	-88.53	552.69	27.05	0.28	515.50	542.55	542.27
2012	28.19	157.65	15.77	433.62	17.53	-652.76	12.12	0.00	73.91	3.60	-89.63	563.13	27.05	0.28	525.64	552.69	552.41
															536.08	563.13	562.85
															0.638	0.324	0.263

Table 14.7.1 ECONOMIC SENSITIVITY ANALYSIS

SENARIO	DESCRIPTION	E I R R (%)		
		Level 1	Level 2	Level 3
0	Data from Table 14.2.1.	63.8	32.4	26.3
1	Loss of Rev: None Health Cost: 10% Up Cost of Pvt Wtr: 10% Up	61.6	31.6	25.7
2	Loss of Rev: 10% Up Health Cost: No change Cost of Pvt Wr: No change	63.5	32.1	26.0
3	Loss of Rev: 10% Up Health Cost: 10% Up Cost of Pvt Wtr: 10% Up	61.3	31.3	25.4

Explanation:
1 Scenario 0 is based on column (15) through (17).
2 Loss of Revenue = (col(2)+col(3))*0.1 for 1996-2012.
3 Increase in Health cost refers to colum (10).
4 Increase in Cost of Pvt Water refers to column (9).
5 All columns indicated above are from Table 14.2.1.

CHAPTER 15 PROJECT EVALUATION

Project Evaluation as presented in this Chapter shall consist of the socioeconomic, technical, environmental assessment and economic/financial aspects discussed hereafter.

15.1 Socioeconomic Aspects

(1) Needs and Beneficiary

The Balara plant serves 6,000,000 persons, approximately 60% of MWSS service area population. Existing Plant No. 1 and Plant No. 2 were constructed 59 years ago and 33 years ago, respectively and these were modified and upgraded in 1981. However, after the modification they have not been rehabilitated sufficiently. Consequently most of the equipment are very superannuated and instrumentation have broken down. In order to maintain the supply of water with good quality and to ensure steady operation and maintenance, large scale rehabilitation of existing facilities is urgently required. Therefore, this project is very vital with 6,000,000 persons to benefit from it.

(2) Cost effectiveness in Relation to Other Projects

Clean water supply is one of the necessities in urban living. If the growth and concentration of population of Metro Manila will continue, conservation and development of water resources will be most important so as to meet the increasing future demand of clean water. However, this would require huge investment and longer implementation. To effect immediate impact, rehabilitation of the Balara Plant can be undertaken instead in a shorter period and at a much lower cost. The rehabilitation work on the existing facilities are required to cope with some adjustments on the planned supply and demand of clean water prior to other expansion projects being implemented by MWSS. As such, the rehabilitation project is extremely important.

(3) Social Impact

The Balara service area covers half of Metro Manila including Manila, Quezon City, San Juan, Mandaluyong, Makati and Pasay. To maintain public health in these areas, ample water supply shall be provided for. Consequently a healthy environment for overseas and international relations will exist which will in turn benefit the whole country.

15.2 Technical Aspects

(1) Principle of Rehabilitation Plan

As previously mentioned, equipment in the Balara Plant are superannuated. If simultaneous breakdowns occur with the main equipment namely: rapid mixer, filter control device, alum feeder, chlorinator, the supply of sufficient amount of safe water cannot be insured. Over and above the need of replacing these equipment, existing facilities have some deficiencies in the light of normal or prevailing technological standards. Examples are: (1) Sedimentation basins have no launders (2) High passing velocity is forced in sedimentation basins (3) Curved structure causes unbalanced current in sedimentation basins in Plant No.1 (4) Ungraded filter media of anthracite is used in filter beds without replacement (5) Surface washing pipe is provided with perforations with an ineffective angle (6) Insufficient washing is attributed to submerged launders during washing in Plant No.2 filters.

Level 1 rehabilitation plan consists of urgent and survivable replacement of equipment, while Level 2 includes more equipment and considers steady operation and maintenance after completion of this project. Level 2 rehabilitation plan includes equipment which are expected to break down after being worn out and after exceeding actual life of the equipment such as flocculators of Plant No. 1 and alum feeder. Accordingly, immediate rehabilitation of the Balara Plant is urgently needed.

(2) Water Quality

At present, turbidity of the service water , one of the most significant factors in evaluating water supply , occasionally exceeds the National Standards for Drinking Water, 1978. Even after chlorination could be successfully done, the effectiveness of chlorine depends upon the chlorine making contact with the bacteria. The suspended particles in turbid water can shelter bacteria from the chlorine. The bacteria may then travel to the distribution area, reach the consumer, and cause disease.

Therefore, the rehabilitation of the Balara Plant is aimed not only to restore the designed capacity but also to improve treated water quality and achieving the safe water supply could contribute to the public health improvement in Metro Manila.

(3) Cost Performance

The plant capacity (nominal) at present and that which is to be rehabilitated is 1,600,000 m^3/d, one of the largest water treatment plant capacities in the world. The project cost of Level 2 rehabilitation is estimated at approximately ₱687 million and Level I is ₱286 million. The above stated rehabilitation costs are quite minimal for the capacity of the plant that shall be operational. Therefore, the urgent implementation of the rehabilitation plan for Balara is imperative.

15.3 Environmental Aspects

The proposed project consists mainly of the replacement of existing equipment and very minor civil works. The purpose of the rehabilitation is to recover the capacity as modified in 1981 in the case of Level 1 or for Level 2 to improve the water quality and proper operation and maintenance to obtain greater benefits. Therefore, there are no potential lasting adverse environmental effects that were identified during this feasibility study. Although there is one small stream crossing the premises to which removed sludge from raw water is being discharged, there are no wildlife habitants and spe-

cific vegetation exist in the area.

However, from human resource and public health aspects, particularly in Metro Manila, immediate implementation of the project is recommended.

15.4 Economic and Financial Aspects

The rehabilitation project of Level 1 and of Level 2 can both be justified on economic and financial grounds. Both Level 1 and Level 2 can also stand against the most adverse situations, as discussed in sensitivity analysis of chapters 13 and 14. However, some qualitative differences of the project between Level 1 and Level 2 require attention. Furthermore, some of the key parameters affecting economic and financial benefits, as well as MWSS cash flow are worth a closer examination not only for those who are directly involved in but also those who are affected by the project.

Some of these differences are as follows:

1) The project cost of Level 1 is approximately 42 % of that of Level 2, while equipment cost of Level 1 is about 90 % of that of Level 2.

2) The Level 1 project rehabilitation requires additional equipment reinvestment in the amount of 237 million pesos in the approximately sixth year due to natural wear and tear of the other non-rehabilitated equipment.

3) Major qualitative differences in equipment quality and durability between Level 1 and Level 2 exists. The differences in chemical/chlorination and electrical equipment of the plants between Level 1 and Level 2 are major factors affecting not only operational efficiency of both plants but also their durability.

The conservative estimate of the breakdown probability of Level 1, runs somewhere between 5 and 10% higher than that of Level 2. This may be translated into operational efficiency of Level 1 as, say,

0.9, as compared with that of Level 2.

While it is difficult to translate qualitative differences between Level 1 and Level 2, if not impossible, an attempt in evaluating the trade off between Level 1 and Level 2 is of great value in a decision making process.

Some reasonable and realistic assumptions are necessary to bridge a gap existing between Level 1 and Level 2. A simple way of doing this is to translate operational efficiency of Level 1 into 90% of Level 2.

When FIRR of level 1 is recalculated on the basis of operational efficiency, FIRR of 7.8% changes to 7.02%. A mid point between adjusted FIRR of Level 1 and FIRR of Level 2 is 6.2% in row (7) of Table 15.1.1.

The base funds of Level 1 was assumed at 286 million pesos. When the base funds increase by 10%, the adjusted Level 1 FIRR turns to 6.69%. Similarly, an increase of base funds by 20%, 30%, and 40% results in the adjusted Level 1 FIRR of 6.37%, 6.06%, and 5.78%, respectively. A summary of this computation is found in Table 15.1.1.

Fig. 15.1.1 presents the relationship between Level 2 of FIRR 5.4% and adjusted FIRR of Level 1 as funds increase from 286 to 571 million pesos. 5.4% of Level 2 FIRR is justified in the sensitivity analysis of Chapter 13. The adjusted FIRR of Level 1 decreases from an initial level of 7.02% to 4.31% when Level 1 funds become doubled. However, a point of intersection between the horizontal line of 5.4% and the declining FIRR provides the maximum increase of Level 1 funds, beyond which the increase of funds may not be justified simply because FIRR falls below 5.4%.

It is up to decision makers at which point the trade off benefits between Level 1 and Level 2 are to be determined. The budget area ranges between 285 and approximately up to 60% increase of initial Level 1 budget, provided that 5.4% is interpreted as minimum level of FIRR.

Cash flow situation of MWSS is as equally important as the trade off between Level 1 and Level 2. To get a picture of cash flow into proper perspective, cash flow scenarios are assumed on the basis of column (12) of Table 13.7.4.

Given the level of water production and quality management, two parameters are vital in affecting water revenue. One is distribution efficiency, and the other bill collection efficiency. Revenue efficiency at present is 32% on the basis of actual data between 1986 and 1990. Financial projection toward year 2000 is expected to increase up to 40%, over 25% improvement of water revenue collection on the current revenue efficiency.

A 10% increase of revenue efficiency, instead of 25%, was employed to compute water revenue. Water production multiplied by the average tariff of 5.48 pesos/m^3 and further multiplied by revenue efficiency of 35% (10% increase of 32% = 35%) for year 1999 and beyond was employed. Then the present value of base figure in column (12) of Table 13.7.4 was computed and used as a base.

Scenario 1 presents a change in revenue efficiency by 2% from year 2001 and beyond resulted in an improvement of the annualized present value of cash flow by 3.9%.

Scenario 2 adds more improvement over the total expenditure. Total expenditure of column (8) decreases by 2% from year 2001 and beyond. An improvement of the annualized present value of cash flow was 6%.

Finally, Scenario 3 combines Scenario 1 and 2. The result was 9.9% improvement.

A summary of three scenarios is presented in Table 15.1.2.

Three policy parameters have been discussed to control cash flow of MWSS. Besides, there are other parameters to be considered. These may include: improvement of water distribution efficiency, water connection manpower efficiency, billing collection efficiency, more productive utilization of manpower, an increase of internal cash

generation, and more importantly, more efficient multi-project management.

Table 15.1.1 TRADE OFF BETWEEN LEVEL 1 AND LEVEL 2

(1)	% Increase	0% Up	10% Up	20% Up	30% Up	40% Up	50% Up	60% Up	70% Up	80% Up	90% Up	100% Up
(2)	Level 1 Funds (M Pesos)	285.556	314.112	342.667	371.223	399.778	428.334	456.890	485.445	514.001	542.556	571.112
(3)	Level 1/Level 2 Funds Ratio	41.6%	45.7%	49.9%	54.0%	58.2%	62.4%	66.5%	70.7%	74.8%	79.0%	83.1%
(4)	Efficiency (Lev 1/Lev 2)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
(5)	Level 1 FIRR	7.80%	6.56%	6.13%	5.73%	5.36%	5.01%	4.68%	4.37%	4.09%	3.82%	3.57%
(6)	Adjusted FIRR of Lev 1	7.02%	6.69%	6.37%	6.06%	5.78%	5.50%	5.24%	4.99%	4.75%	4.53%	4.31%
(7)	Mid point FIRR (Lev 1 & Lev 2)	6.20%										

Explanation of Row:
1 Percentage increase.
2 Level 1 funds increase at a 10% interval.
3 Ratio of Level 1 funds divided by Level 2 funds.
4 Level 1 overall efficiency is assumed 90% of Level 2.
5 Simulation was conducted on the basis of Table 13.3.2.
6 Row(6) = Row (4) multiplied by Row (5).
7 Row(7) = 6.20%

Table 15.1.2 CASH FLOW SENSITIVITY ANALYSIS

SENARIO	DESCRIPTION	ANNUALIZED PERCENTAGE IMPROVEMENT OF PRESENT VALUE CASH FLOW BY SENARIO
1	Total Revenue of column (5) increases by 2% from year 2001 and beyond	3.9
2	Total Expenditure of column (8) decreases by 2% from year 2001 and beyond	6.0
3	Total Revenue of column (5) increases by 2% from year 2001 and beyond Total Expenditure of column (8) decreases by 2% from year 2001 and beyond	9.9

Explanation: 1 Present value of cash flow is column (12) of Table 13.7.4 discounted at 15% of social discount rate.
2 The base figure was taken from the annual average of the present value column (12).

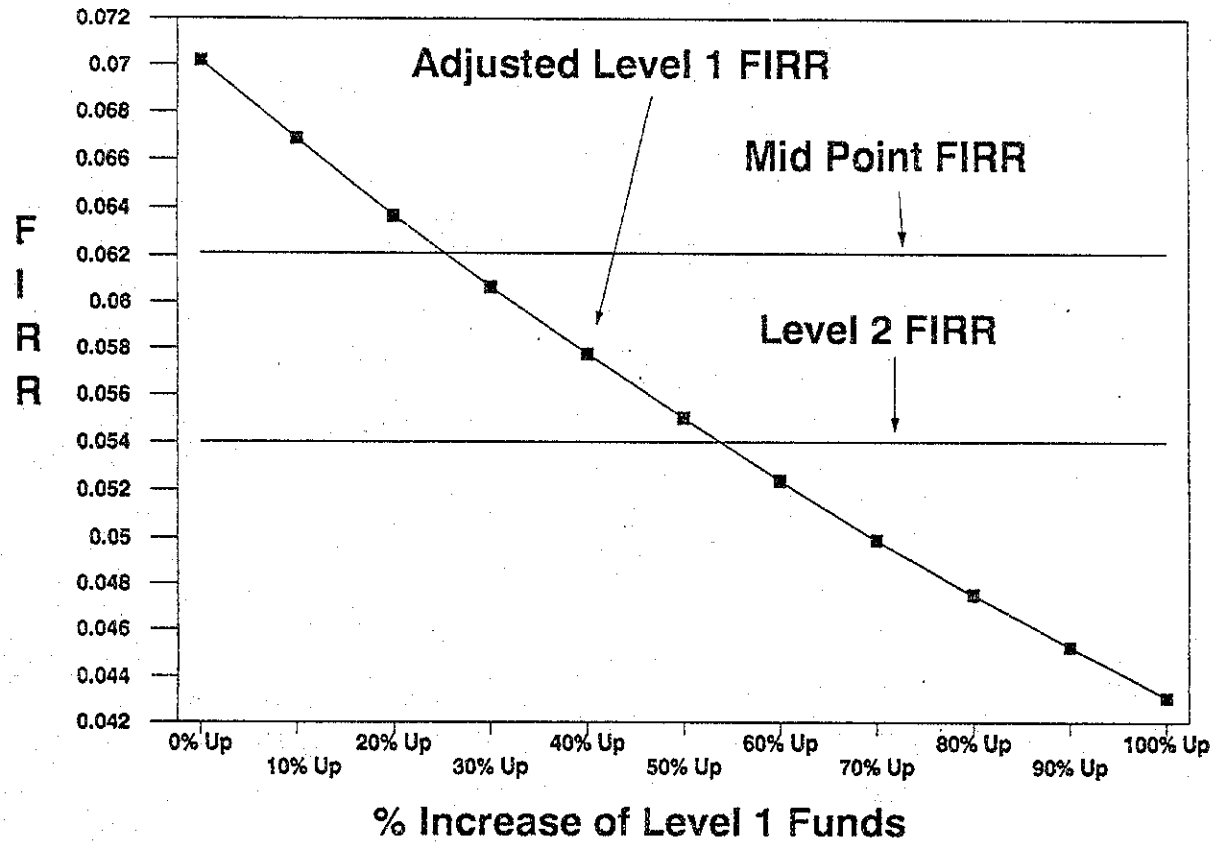


Fig. 15.1.1
TRADE OFF BETWEEN
FIRR & BUDGET

CHAPTER 16 CONCLUSION AND RECOMMENDATION

16.1 Conclusion

The provision of safe and stable supply of water to the populace is of utmost importance particularly in Metro Manila. The rehabilitation of the Balara Water Treatment Plant one of two large water treatment plants providing water to 60% of the MWSS service area is therefore urgently required.

The capacity (nominal) to be rehabilitated in the proposed project is 1,600,000 m^3/d in restoring the capacity modified in the project of 1981.

16.1.1 Highlights of the Project

Proposed rehabilitation work on the Balara Water Treatment Plant is presented in three levels of rehabilitation and the rehabilitation plan to be implemented shall be determined based on the following:

- Considering technical/engineering aspects, Level 2 is preferable since it will be fundamental rehabilitation. It includes the improvement for water quality management technically in corporated over and above Level 1 rehabilitation items. Furthermore it includes replacement of the worn-out equipment insuring steady O&M for years to come.

- In case of financial constraints, Level 1 (or equivalent alternative) could be the second choice since Level 1 consists only of minimal replacement of the worn-out equipment and of vital service devices such as chlorination. Level 1 can be defined as urgent and survivable rehabilitation.

- Economic and financial analysis indicate that the EIRR of Level 2 was computed at 32.4% and its FIRR at 5.4%. While the EIRR of Level 1 was computed at 63.8% and its FIRR at 7.8%. Therefore both levels are justified. Sensitivity analysis strongly indicates that Level 1

and Level 2 both can stand against the worst Scenario 3.

Considering all aspects of the Project, namely the engineering evaluation and economic/financial analysis and the present financial situation at MWSS, it is best to adopt Level 1 rehabilitation plan (or equivalent plan) first and implement it as closely as possible gradually to the grade of Level 2, should the two stage implementation be approved.

Table 16.1.1 presents the targets for improvement and rehabilitation for Level 2 and the items for Level 1 are indicated in the column for the remarks.

16.1.2 Expected Durability

Most of the worn-out equipment will be replaced in the proposed Level 2 Rehabilitation Plan. Results of the structural examination on civil and architectural facilities revealed that the concrete structure will still last for more years. Therefore, the determining factor for the life of the Project is the durability of the equipment to be replaced. Usually the life of these equipment is 15 years. Accordingly, the expected life of Level 2 is 15 years.

Should Level 1 be adopted, the life of the system will be approximately 5 years because the components of the worn-out equipment to be replaced are limited to the bare minimum level, as an emergency countermeasure. Consequently, additional replacement of the equipment will be needed during or after the rehabilitation.

16.1.3 Project Cost and Implementation schedule

Total project cost of Level 2, consisting of construction cost, engineering fee and physical contingency, amounts to ₱686,947 thousand at 1991 price level. For reference, total project cost of Level 1 is estimated at ₱285,556 thousand.

Construction/Rehabilitation shall cover two years to include a dry season in the interim. Assuming that negotiations for external

financial resources commence in early 1992, the proposed rehabilitation work will be completed until the end of 1995 including engineering service and bidding procedure.

16.1.4 Economic and Financial Analysis

Both Level 1 and Level 2 projects are feasible on economic and financial grounds. Furthermore, both Level 1 and Level 2 can stand adverse situations affecting the project situations.

While it is difficult to determine whether Level 1 or Level 2 will be adopted, the project should definitely be approved. An attempt was made to examine the trade off between Level 1 and Level 2, taking into account some qualitative differences between these two rehabilitation levels of the project. The results that are summarized in Table 16.1.2 indicates that there exists a range of options somewhere closer to 50% increase of Level 1 funds over to current ₱286 million if a mid point between adjusted curve of Level 1 and horizontal line of Level 2 were to be preferred.

This does not necessarily reflect our concerted assessment among our study team, but indicates a reasonable solution to the trade off issue facing the assessment committee of the Balara Rehabilitation Project.

A summary of selected key indicators is presented in Table 16.1.2.

16.2 Recommendation

After a detailed evaluation of the existing conditions of the Balara Water Treatment Plant and the proposed rehabilitation works and the benefits to be derived, the team recommends that:

- The Government of the Philippines and MWSS proceed with execution of the detailed design as soon as possible because of the urgency of the rehabilitation work required to cope with the advancing stage of deterioration of the existing facilities.

- Should financial limitations exist as stated in Chapter 15, MWSS should implement the Level I rehabilitation or equivalent plan which are within Level 2 as allowable.

- MWSS strongly desires Japanese Grant-Aid. As the completion of the work will take about four years in any case some of equipment in the Plant will be breakdown, then MWSS have to cope with the situation without reservation as soon as possible. Because the capability of change order for items to be rehabilitated will be exist until bidding procedure.

- In connection with the Balara Plant, the following some items are recommended:

  a) After the rehabilitation work, MWSS should always establish periodical preventive repair scheme including spare parts purchase, replacement of worn-out equipment and painting of steel portions. Simultaneously the budgets for it shall be ensured by the management.

  b) In order to facilitate for future any rehabilitation work on the Balara or the La Mesa plant on large scale, the interconnection pipe between La Mesa No. 2 and the Balara plant will have to be implemented.

  c) At present, the distribution pipelines of the Balara and the La Mesa service area are interconnected only at the Manila South portion and there is no provision for utilization of water in their respective pipelines during emergencies. Should one of the plants or one of the main lines stop functioning, a major shutdown of water supply will occur. Hence, MWSS could not stop the operation of each plant should there be a need. Therefore, interconnection in a number of points between both services areas are recommendable.

  d) More distribution reservoirs should be rehabilitated to allow for emergency situations.

e) Leakage prevention in the distribution network should be attended to make the plant performance efficiently, to prevent vain expansion of the plant and to make the system financially stable by deducting non-revenue water.

f) While La Mesa Water Treatment Plant No. 1 has a sludge lagoon, the Balara plant does not. Standard designs and programs to furnish unified facility plan on sludge treatment facilities for the Balara Plant should be prepared.

Table 16.1.1 RECOMMENDED REHABILITATION PLAN

PLANT NO.1

* indicates common items with Level 1

DESCRIPTION	Q'TY	REHABILITATION	REMARKS
Aqueduct No.1 & No.2 Guide of Sluice Gates	4 units	Replacement	*
Rapid Mixing			
Rapid mixers	2 units	Replacement	*
Baffle walls	L.S.	Construction	
Flocculation			
Flocculators	26 units (2 units for spare)	Replacement	* Spare only for Level 1
Control panel house	L.S	Construction	
Sedimentation			
Drain valves for Sedimentation Basin No.1 & No.2	6 units (basin)	Replacement	
	4 units (channel)	Replacement	
Collecting launders with perforated baffle wall	20	Construction	
Baffle walls	L.S.	Construction	
Sludge discharge creek	L.S.	Excavation	*
Accelator			
Driving units	2 units	Replacement	
Sludge blow-off equipment	2 sets	Replacement	
Corroded steel members	L.S.	Repair	
Operation house	L.S.	Repair	*
Filtration			
Sheets of inlet and drain sluice gates	10 units	Replacement	
Pumps and air compressors for hydraulic control	2 units each	Replacement	
Anthracite	810 m3	Replacement	Supplement only for
Surface wash	L.S.	Improvement	Level 1
Venturi tube	10 units	Replacement	
Washwater pumps	3 units	Replacement	*
Pump house	L.S.	Repair	*
Washwater Recovery			
Washwater pumps	3 units	Replacement	*
Pump house	L.S.	Reconstruction	*
Washwater returning points	L.S.	Change of point	

PLANT NO.2

DESCRIPTION	Q'TY	REHABILITATION	REMARKS
Flocculation			
Flocculators	12 units	Replacement	Only driving unit,chains, sprockets for Level 1
Baffle walls	L.S.	Construction	Replacement of wooden plated for Level 1
Control panel house	L.S.		
Sedimentation			
Foundation of inflow sluice gate guide	24 units	Replacement	*
Launders with perforated baffle walls	96 units	Construction	
baffle walls			
Shaft support for drain sluice gate	12 sets	Replacement	*
Flushing pumps	2 units	Replacement	*
Flushing pump house	L.S.	Construction	*
Filtration			
Sheets of influent and drain sluice gate	20 units each	Replacement	
Pumps and air compressors for hydraulic	2 units each	Replacement	
Control			
Anthracite	1,620 m3	Replacement	Supplement for Level 1
Surface wash	L.S.	Improvement	
		(Replacement)	
Washwater troughs	L.S.	Improvement of drainage cap.	*
Washwater			
Washwater pumps	3 units	Replacement	*
pump house	L.S.	Repair	*
Washwater Recovery			
Washwater recovery pumps	3 units	Replacement	
Washwater recovery storage tank and pump house	L.S.	Construction	
Washwater returning point	L.S.	Change of point	

CHEMICAL/CHLORINE FACILITIES

DESCRIPTION	Q'TY	REHABILITATION	REMARKS
Alum Dose			
Feeders	6 units	Replacement	Spare only for Level 1
Calibration flow meter	L.S.	Installation	
Elevated foundation of feeders	6 sets	Construction	
Polymer Dosing			
Feeders	5 units	Replacement	*
Calibration flow meter	L.S.	Installation	
Chlorination			
Chlorinators	4 units	Replacement	*
Evaporators	2 units	Replacement	*
Chlorine leak detectors	3 units	Replacement	*
Exhaust fan	3 units	Replacement	*
Hoist	3 units	Replacement	*
Chlorine booster pumps	3 units	Replacement	*
Dosing pipings	3 units	Replacement	*
Roof	L.S.	Repair	*
Chlorine storage house	L.S.	Expansion	*
Hoisting rail	L.S.	Installation	
Laboratory Equipment	L.S	Replacement	Partly for Level 1

ELECTRICAL EQUIPMENT AND INSTRUMENTATION

DESCRIPTION	Q'TY	REHABILITATION	REMARKS
Power Receiving			
Poles and wires	24 pcs	Replacement & Improvement	Replacement only for Level 1
Power Receiving Panel and Others	1 unit	Installation	
Low Voltage Main Service Line			
Overhead wires	L.S.	Replacement	*
Low Voltage Power Line Improvement Equipment	6 units	Installation	
Motor Control Panels	28 units	Replacement	Partly for Level 1
Lighting Panel	2 units	Replacement & Modification	
Distribution Panel	2 units	Replacement	*
Starter Switch for Chlorine Booster Pump	1 unit	Replacement	*
Flow Meter			
Flow Meter (1)	10 units	Replacement	Only Accelator & Parshall
Flow Meter (2)	2 units	Installation	Flume
Level Meter	7 units	Replacement	*
Instrumentation of Filter beds			
Loss of Head Devices	30 units	Replacement & Modification	*
Rate of Flow Devices	30 units	Replacement & Modification	*
Instrument Panel	1 unit	Replacement & Modification	Partly for Level 1
Interior Lighting	L.S.	Replacement & Improvement	
Street Lighting	L.S.	Replacement	
Lightning Facilities	L.S.	Installation & Modification	Partly for Level 1
Generator for chlorination Equipment	1 unit	Installation	*
Testing Equipment	L.S.	Procurement	*

Table 16.1.2 BALARA REHABILITATION PROJECT: SELECTED INDICATORS

Project Level	Local Funds	Foreign Funds	Total Funds	Equipment Cost	WACC (%)	EIRR (%)	FIRR (%)	ADJUSTED Level 1 FIRR	Level 1 Bud't Inc	Adj'd BUDGET
Level 1	53.913 (290.583)	231.643	285.556 (522.226)	147.310 (305.090)	5.02	63.8	7.8	Max: 7.02	None	285.556
Level 2	155.621	531.326	686.947	336.580	5.49	32.4	5.4		50%	428.334
Level 3	189.930	715.780	905.710	446.301	5.28	26.3	0.1	Min: 4.31	100%	571.112

Note: 1 Additional amount of 236.67 million pesos as local funds in level 1 is required in keeping functional effectiveness at its minimum, and is not intended to upgrade toward level 2.
2 The figure of 290.583 of level 1 local funds is the sum of 53.913 and 236.67. The present value of 290.533 at the end of 1998 at SDR of 15% = 125.627.
3 The figure 522.226 = 290.583 + 231.643. The present value of 522.226 = 225.773 at the end of 1998 at SDR of 15%.
4 Total cost of equipment = 147.310 + 157.780 = 305.090. The present value of 305.090 = 131.899 at the end of 1998 at SDR of 15%.